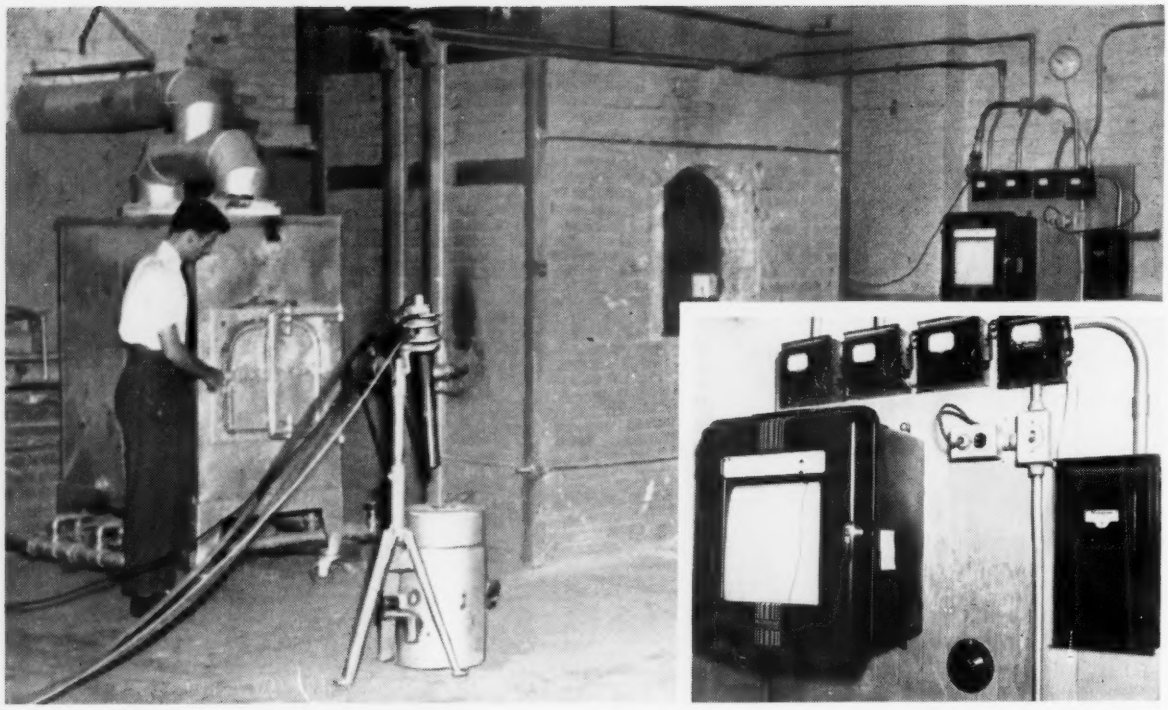
CERAMIC ABSTRACTS and THE BULLETIN

OF THE

AMERICAN CERAMIC SOCIETY

JANUARY 15, 1944

MONTHLY PUBLICATION DEVOTED TO THE ARTS AND SCIENCES RELATED TO THE SILICATE INDUSTRIES



A corner of the laboratory of the Ceramic Engineering Dept., North Carolina State College, Raleigh, N. C. Insert shows their Micromax Pyrometer for either thermocouple or Rayotube.

Effective Use of Micromax Pyrometers In This Ceramic Engineering Lab.

The laboratory shown above has an extremely efficient and economical set-up for measuring the temperatures of its kilns and furnaces, because either a thermocouple or a Rayotube can be switched instantly to the Micromax Pyrometer shown at the right. The Micromax has two ranges; one of 0–3000° F for thermocouples, and one of 1400–3000° F for Rayotubes. Both thermocouple and Rayotube are permanently wired to the pyrometer, and either can be connected by simply throwing the switch. This arrangement would seem to be widely applicable in engineering laboratories.

A typical Rayotube use is in the small cylindrical furnace, where the pyrometric-cone equivalents of refractory materials are determined by ASTM Std. C 24–42. This test requires the material to be heated at consecutively changed rates. Thermocouples have too much lag for this service, and an optical pyrometer has too much "human equation." But the Rayotube, with neither lag nor human equation, solved the problem. In the words of Prof. R. L. Stone, "We follow the ASTM schedule perfectly. It's hard to realize that we used to get along without Rayotubes. Students do better work with them, and Rayotubes also give improved results in industrial consulting."

For a description of Micromax Pyrometers, thermocouples and Rayotubes, see an L&N engineer, or consult Catalog N-33A on thermocouples, or N-33B on Rayotubes.

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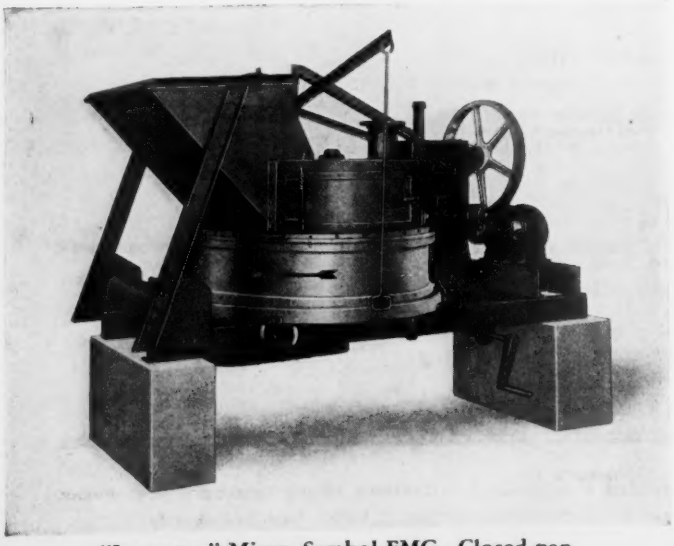

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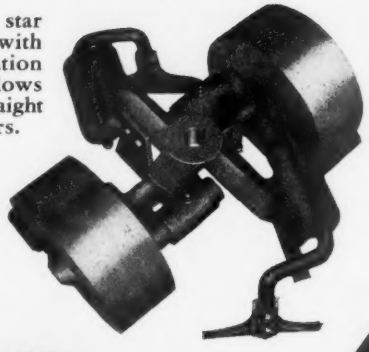
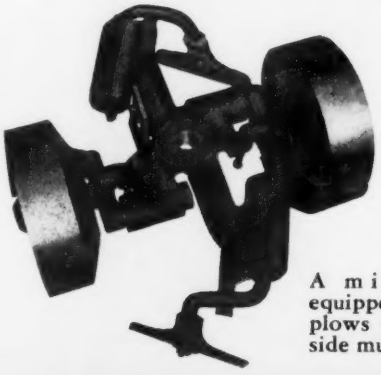


A mixing star equipped with a combination of two plows and two straight side mullers.



A mixing star equipped with two plows and two bevel side mullers.

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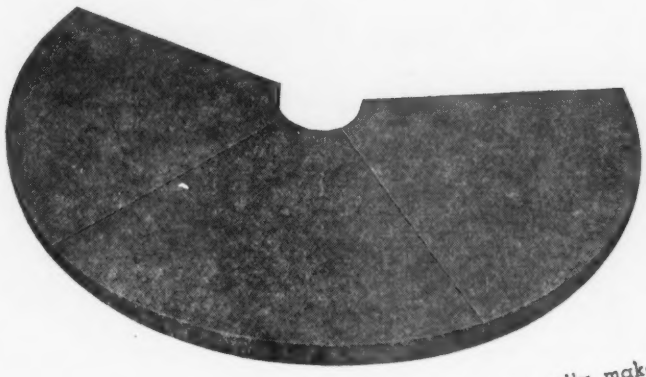

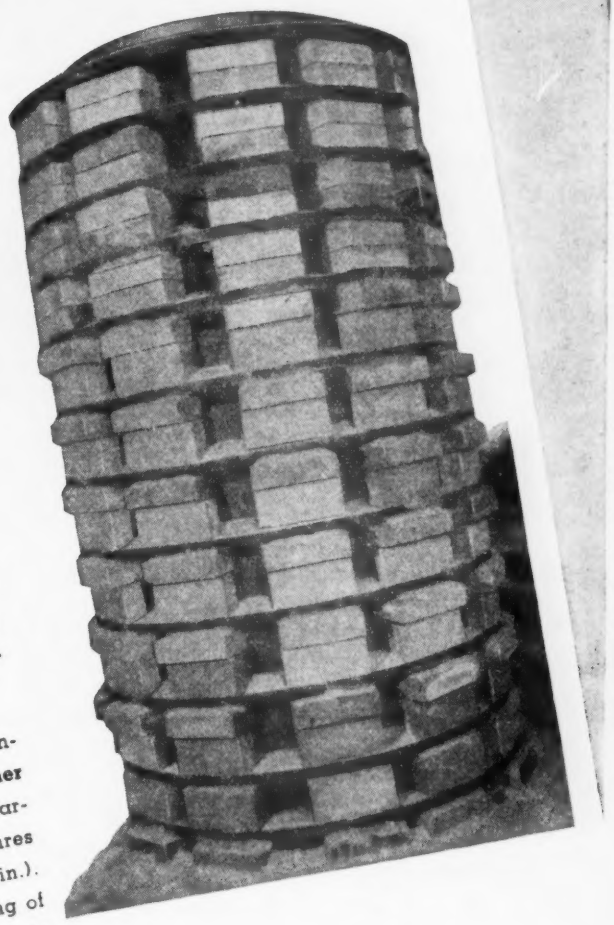

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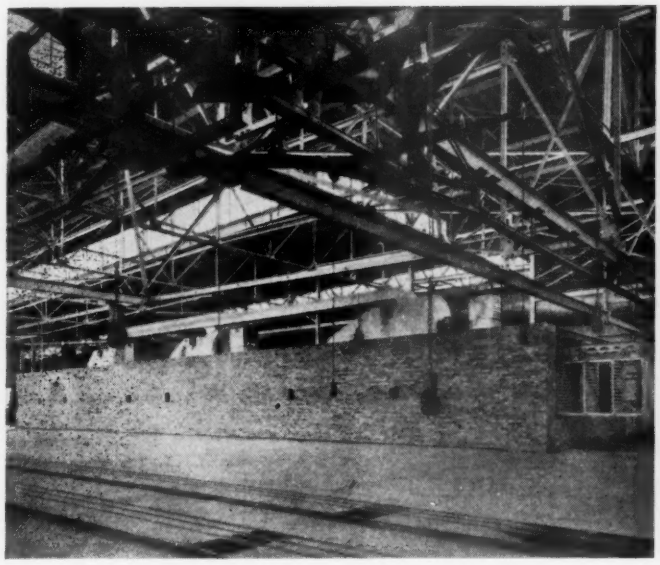

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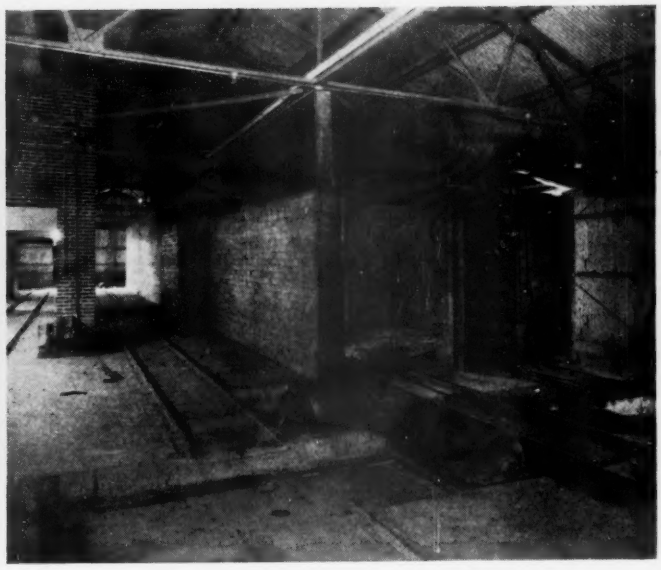

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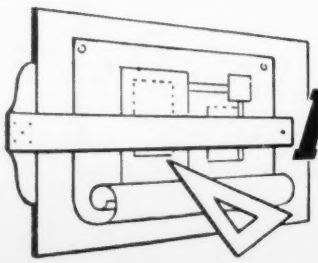

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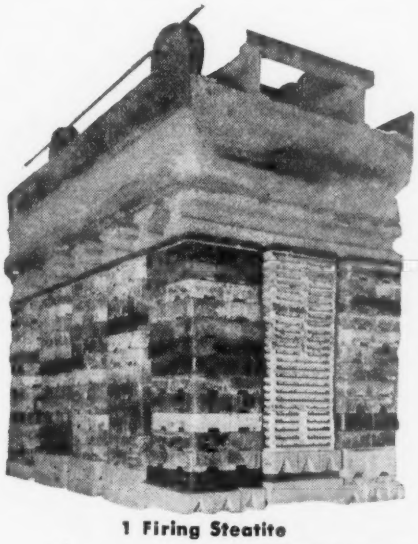

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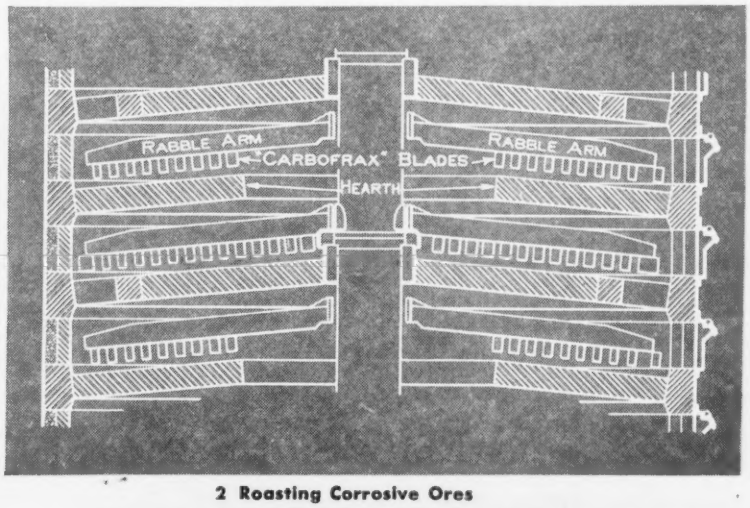

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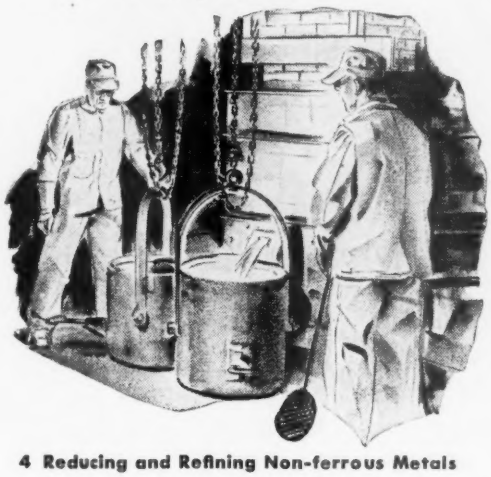

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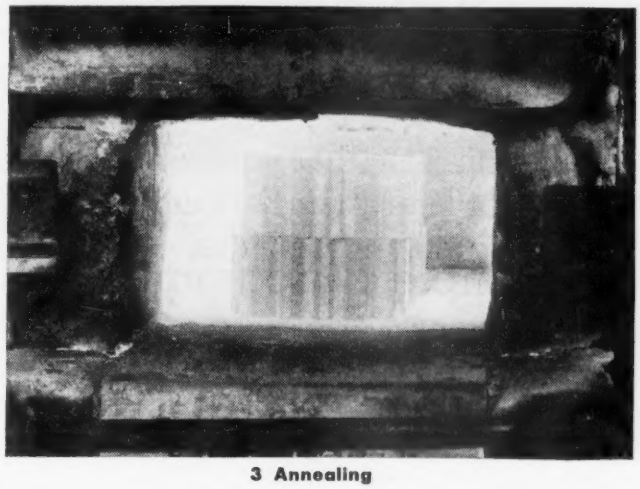

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Vol. 23 **January 15, 1944** **No. 1**

Abrasives

Abrasaw cut-off machine. ANON. *Machinery* [N. Y.], **50** [2] 202 (1943).—The 47P streamline Abrasaw cut-off machine is manufactured by the Bridgeport (Conn.) Safety Emery Wheel Co. R.H.B.

Abrasive points with demountable spindles. ANON. *Machinery* [N. Y.], **49** [12] 232 (1943).—The Abrasive Co., Philadelphia, Pa., has announced a new development in abrasive mounted wheels and mounted points known as Victory points. The outstanding feature of the points is the demountable spindles; the spindle can be removed and used with other points, thus saving steel. R.H.B.

Blake tap grinder. ANON. *Machinery* [N. Y.], **50** [1] 190 (1943).—A new tap grinder for sharpening the chamfer on taps ranging in size from No. 0 to 2 in. in diameter and up to 14 in. in length has been announced by the Edward Blake Co., Newton Center, Mass. R.H.B.

Chip-breaker grinder for Carboloy tools. ANON. *Machinery* [N. Y.], **49** [12] 224 (1943).—A new chip-breaker groove grinder for Carboloy tools having greater flexibility and higher production capacity than previous models has been brought out by the Carboloy Co., Inc., Detroit, Mich. See "New . . .," *Ceram. Abs.*, **22** [10] 167 (1943). R.H.B.

Covel universal cutter and tool grinder. ANON. *Machinery* [N. Y.], **50** [2] 198 (1943).—A No. 12 universal cutter and tool grinder of the Covel Mfg. Co., Benton Harbor, Mich., is described. See *Ceram. Abs.*, **22** [5] 65 (1943). R.H.B.

Cylindrical grinding with a flat belt. E. A. HEPNER. *Amer. Machinist*, **87** [22] 86–87 (1943).—In a special setup for grinding Alnico sticks (magnets) to size, 0.015 to 0.02 in. of stock is removed; the bench grinder makes 3450 r.p.m. M.HA.

Dust-free grinding. F. SCHOEFFLER. *Nat. Safety News*, **47** [5] 18–19, 84 (1943).—Increased production and lower labor costs have resulted from a complete modernization of the grinding-room equipment at the Lodge & Shipley Machine Tool Co. plant in Cincinnati, Ohio. All grinding work on castings is concentrated in one building along with blast cleaning equipment. An efficient venting system makes the use of respirators unnecessary for routine operations. S. discusses (1) grinding-booth design, (2) downdraft ventilation, and (3) blast cleaning operations. Illustrated. M.R.

Feed table for abrasive-belt surface grinders. ANON. *Machinery* [N. Y.], **50** [1] 192 (1943).—The Porter-Cable Machine Co., Syracuse, N. Y., has developed an in-out feed table designed to obtain speedier and more accurate surface grinding of disks, squares, and other small parts on the Porter-Cable G-4 belt-type grinder. R.H.B.

Finest grinding of hard-metal edges with most economic use of diamond wheels. K. ENGELHARD. *Z. Ver. Deut. Ing.*, **87** [7–8] 111–12 (1943).—To save diamonds in Germany, finest grinding, i.e., lapping, should be done with diamond wheels only if no other grinding means can produce the same results. Previous grinding must be done with silicon carbide wheels (see following table):

Work	Grain size	Hardness (Norton scale)	Grinding speed	Edge quality
Pregrinding	46	H–I	About 25 m./sec. (manual)	
Finish grinding	80–100	H–I	About 5–10 m./sec. (mech. feed)	25 μ (roughing tools)
Honing with silicon carbide tools	About 400	M	Manual	10 μ
Lapping	180 and finer	H (manual grinding)	25 m./sec. (manual)	5–10 μ (tools for smoothing and finest lapping)
		H–JOT (mech. feed)	5–10 m./sec. (mech. feed)	
Grinding of turned piece	About 120	K–M (manual)	25 m./sec. (manual)	10 μ for subsequent honing by hand
		JOT–K (mech. feed)	20 m./sec. (mech. feed)	

If a diamond wheel is still required, it should be used in such a manner as to give the longest life possible for the wheel and be restricted to those cases, e.g., edge quality, which lie below 5 μ roughness. The diamond wheel

should have a grain size of 20 to 40 μ and a speed of 15 to 25 m./sec.; its properties should be as follows:

Composition	Application	Obtainable surface and edge quality
Artificial resin binder (10–15% by vol. diamonds)	Only for lapping for edges of highest quality, not for grinding to dimension and not for profile grinding. The diamond wheel should be used for lapping only if no subsequent working, e.g., honing, is done	2 μ
Metal binder (20–30% by vol. diamonds)	For plane grinding of hard metal surfaces, dimension grinding of rotating tools (reamers, milling heads), and profile grinding (profile steels)	3 μ

Finest grinding must be done with the least pressure and motion of the tool on the wheel, especially of rotating tools (milling heads), and the feed must be very small to keep the wheel open. Wet grinding is recommended. M.HA.

Fitchburg automatic precision grinders. ANON. *Machinery* [N. Y.], **50** [1] 186 (1943).—The Fitchburg (Mass.) Grinding Machine Corp. has brought out two new types of plain cylindrical automatic precision grinders: type B 6-in. and type B 10-in. See *Ceram. Abs.*, **22** [5] 65 (1943). R.H.B.

Flexible abrasive for cutting, cleaning. ANON. *Ind. Finishing*, **19** [8] 78 (1943).—Where smoothness of surface is more important than accuracy of contour, several types of flexible abrasive surfaces now available can be used for the smoothing operation. Soft rubber charged with abrasive or inflated rubber drums coated with abrasive are particularly suitable. C.W.

Formed-wheel ball-groove grinder. ANON. *Machinery* [N. Y.], **50** [2] 192 (1943).—The Gear Grinding Machine Co., Detroit, Mich., has built a special Geargrind machine designed for grinding the ball grooves in the outer housing of Rzeppa constant-velocity universal joints. R.H.B.

Grinding-wheel accidents. ANON. *Nat. Safety News*, **47** [4] 26–27, 102–106 (1943).—Grinding-wheel accidents accounted for 4% of all reported machinery injuries in the nonmetal manufacturing industries of Pennsylvania during 1940. Out of 122 grinding-wheel accidents, 23 were caused by inadequate eye protection, 22 by improper holding of work, 15 by improperly adjusted rest, and another 15 by cleaning, adjusting, or gauging work with the wheel in motion. Defective wheels caused 11 accidents, and excessive wheel speed caused 7. The circumstances and causes are discussed. M.R.

Improved tap reconditioner. ANON. *Machinery* [N. Y.], **50** [3] 210 (1943).—An improved design of tap reconditioner or grinder has been announced by the Detroit (Mich.) Tap and Tool Co. The new spindle head accommodates a wide range of motors for the various service voltages, phases, and frequencies required in the industry. R.H.B.

Profilometer for accurate measurement of surface roughness. ANON. *Machinery* [N. Y.], **50** [2] 206 (1943).—The type Q profilometer has been designed by the Physicists Research Co., Ann Arbor, Mich. R.H.B.

Securing fine surfaces by grinding: IV. H. J. WILLS. *Machinery* [N. Y.], **49** [12] 201–203 (1943).—The cutting action of any grinding wheel varies with changes in the area of contact between wheel and work, the ratio of wheel and work speeds, the rate of traverse, and the amount of in-feed. To determine the proper operating conditions for a well selected wheel on a machine that is in good running order or to manipulate a wheel that is not exactly suited to a job so that it will give satisfactory results, the grinding operator must understand how these factors affect wheel performance. These topics are explained. **V.** *Ibid.*, **50** [1] 172–74 (1943).—W. deals with the selection of dressing tools. Although the same tools are used for dressing and for truing grinding wheels, there is a clear distinction between the two operations. The face of a wheel is dressed to secure the desired cutting action; it is trued to maintain or change its shape or to maintain its concentricity or parallelism. Most star and disk dressing tools are good only for rough and semirough dressing operations. The solid steel cylinder dressing tool with one or two spiral grooves can be used for dressing wheels to obtain surfaces of about 8 micro-inches r.m.s. If a wheel is to be used both for the roughing cut and for the subsequent finishing cut to produce a high quality of surface, the dressing for the roughing cut may be done with an abrasive stick, while a diamond is used for dressing the wheel for the finishing cut. Where a high grade of fine grinding is not required, a dresser, the cutting element of which is a silicon carbide abrasive wheel, can be effectively used in place of a diamond tool. For really fine dressing, the diamond tool is generally used. Before the war 85% of the machine shops were using African brown bort, gray bort, or ballas stones, because on the average, they give the best results at the lowest cost. Today in the U. S., Brazilian stones only are used. Gray and white bort stones are the hardest, but they are very brittle and therefore easily shattered by a shock or blow. A table for selecting diamond sizes for dressing tools is discussed, and diamond mounting and multiple diamond dressers are described. **VI.** *Ibid.*, [2] 164–67.—W. deals with the application of dressing tools. The dressing of grinding wheels at predetermined intervals increases the life of the wheels and materially helps to maintain a uniform quality finish. Grinding wheels must be balanced before and after truing. The more common grinding faults that result from dressing operations include (1) chatter marks, caused by a dull diamond or a tool improperly held; (2) spirals or threads, caused by cracked diamonds, etc.; (3) grit marks, which may be due to too coarse dressing; (4) wheel loading, caused by a dull diamond; and (5) inaccuracies in work, which may be due to the condition of the grinding machine. For Part III see *Ceram. Abs.*, **22** [10] 167 (1943). R.H.B.

Segment-face contact wheel for driving abrasive belt. ANON. *Machinery* [N. Y.], **50** [3] 224 (1943).—A new segmented-face contact wheel designed to increase the range of work that can be finished with backstand idlers using abrasive belts has been developed and patented by the Minnesota Mining & Mfg. Co., St. Paul, Minn. R.H.B.

Sheffield Micro-Form profile grinder. ANON. *Machinery* [N. Y.], **49** [12] 211 (1943).—The Sheffield Corp., Dayton, Ohio, has developed a Micro-Form grinder equipped with a pantograph and microscope by means of which work can be finish-ground to the required profile with a high degree of precision. It is especially suited for grinding both circular and flat form tools, templets, profile gauges, cams, dies, etc., from hardened materials, including tungsten carbide. It can also be used for making enlarged 50 to 1 layout drawings of parts and for checking parts against layout drawings. R.H.B.

Sundstrand lightweight pneumatic hand-sander. ANON. *Machinery* [N. Y.], **50** [2] 212 (1943).—The Sundstrand Machine Tool Co., Rockford, Ill., has brought out a lightweight nonvibrating Hi-speed Model 1000 pneumatic sander. R.H.B.

Vitrified diamond grinding wheels. ANON. *Ind. Diamond Rev.* (in *Gemmologist*, **13** [147]), **3** [35] 55–58 (Oct., 1943).—Nearly all attempts in recent years to produce bonded diamond wheels excluded the vitrified or ceramic bond and utilized processes whereby the diamond grain was bonded in other substances, such as phenol resin, metal powders, etc. Only recently have suggestions been made to bond diamond in vitrified wheels by varying the ordinary practice in such a way that firing cannot damage the diamond grain, and in this way the extended practice in the production of vitrified grinding wheels for the varied demands of modern industry is utilized for the diamond, the most expensive but also the hardest mineral substance.

Ceramic processes for the forming of diamond grinding wheels are described in Brit. Pat. 462,966, April 1, 1937 (Nov. 23, 1935) and Swiss Pat. 191,628 (1936), but recently three new British patents have been granted. Brit. Pat. 552,246, April 7, 1943 (May 10, 1941) describes a technique for producing vitrified bonded diamond grinding wheels and hones which is simple and gives consistently good results. With reference to the materials used in forming the wheels, the application of silicon has at least two desirable functions: (1) It prevents detrimental swelling of the abrasive body and center due to the evolution of certain gases from the material during the firing in a nonoxidizing atmosphere. (2) It provides at the same time suitable solid granular material for that strongly vitrified bonded framework of the abrasive body which is essential for adequate support of the diamond grains and consequent low wear during grinding. This use of silicon has resulted in nonswelled diamond-containing abrasive bodies of excellent quality, bonded with a vitrified bond matured at about 1000°C. or below in a nonoxidizing atmosphere. Examples of the compositions calculated for the abrasive periphery involving the use of silicon are given. Brit. Pat. 552,248, April 7, 1943 (June 19, 1941) relates to abrasive articles, especially cup-shaped wheels, which a backing has united to one face of integral outer and inner layers, each consisting of vitrified ceramic material, with the outer layer only having diamond abrasive grains bonded by the vitrified ceramic material. Brit. Pat. 552,848, May 12, 1943 (Oct. 22, 1941), comprises mixing a diamond abrasive with a porcelanic bonding material, shaping the mixture, and firing the shaped article in a nonoxidizing or reducing atmosphere, the composition of the porcelanic bonding material and the temperature of firing being so selected that the porcelanic mass matures at or below a temperature at which it reaches maximum density and below that at which the bond softens sufficiently to flow due to formation of excess glass phase. The temperature should not be higher than that necessary to mature the bond to its maximum density and should be kept below the point at which sufficient glass phase would be formed to cause the bond to soften and lose shape. The results may be improved by employing auxiliary abrasive material in addition to diamond which may react, at least partially, with the part of the bond which becomes vitreous during firing and mechanically holds the diamond particles in the vitreous portion: Example 1: feldspar 40, ball clay 30, kaolin 20, and flint 10%. Example 2: feldspar 30, ball clay 20, kaolin 20, and flint 20%. In the specification it is not stated whether the percentage is by weight or by volume.

PATENTS

Abrasive article. A. ABBEY (Carborundum Co.). Brit. 555,640, Sept. 15, 1943 (Jan. 21, 1942).

Abrasive article. LORING COES, JR. (Norton Co.). U. S. 2,332,206, Oct. 19, 1943 (Aug. 12, 1941).—An abrasive article comprising abrasive grains united by a bond composed primarily of a resin formed of copolymerized substances comprising an ester of an alkyl alcohol having not over four carbon atoms and an acid selected from the group consisting of acrylic, chloracrylic, and methacrylic acids copolymerized with an ester of the hypothetical ethylidene glycol and one of the acids.

Abrasive-article manufacture. R. C. BENNER AND R. L. MELTON (Carborundum Co.). Can. 415,291, Sept. 21, 1943 (July 10, 1936; in U. S. Sept. 5, 1935). G.M.H.

Abrasive article and method of making. H. V. ALLISON (Allison Co.). U. S. 2,334,526, Nov. 16, 1943 (May 18, 1942). G. F. KEELERIC. U. S. 2,334,494, Nov. 16, 1943 (Dec. 11, 1942).

Abrasive articles and their manufacture. CARBORUNDUM CO. Brit. 556,272, Oct. 13, 1943 (March 1, 1941).

Abrasive belt grinder. J. G. BAIR AND J. T. SHULL. U. S. 2,333,507, Nov. 2, 1943 (May 13, 1943).

Abrasive-coated sheets for removable attachment to backings. A. ABBEY (Carborundum Co.). Brit. 556,147, Oct. 6, 1943 (Feb. 19, 1942).

Abrasive device. J. F. D. SMITH (Edward G. Budd Mfg. Co.). U. S. 2,331,861, Oct. 12, 1943 (July 29, 1940).

Abrasive tool. R. A. MOORE (T. C. Beshear, assignee of 1/20). U. S. 2,334,642, Nov. 16, 1943 (Aug. 3, 1942).

Adjustable hone. J. J. PALOTCE. U. S. 2,332,463, Oct. 19, 1943 (Dec. 21, 1942).

Apparatus for dressing grinding wheels. COVENTRY GAUGE & TOOL CO., LTD., H. H. HARLEY, AND J. E. WAINWRIGHT. Brit. 556,450, Oct. 20, 1943 (June 12, 1942).

Apparatus for smoothing surfaces. R. W. DAYTON (Norton Co.). U. S. 2,332,133, Oct. 19, 1943 (Jan. 1, 1942).

Apparatus for truing grinding wheels. SOC. GÉNEVOISE D'INSTRUMENTS DE PHYSIQUE. Brit. 556,015, Sept. 29, 1943 (April 30, 1941).

Billet-grinding machine. D. E. MULHOLLAND. U. S. 2,334,023, Nov. 9, 1943 (May 26, 1941).

Broaching machine. E. C. RAEHRS AND C. M. BEACH (Cincinnati Milling Machine Co.). U. S. 2,333,337, Nov. 2, 1943 (July 31, 1939).

Buffing and polishing implement. E. I. HARRISON (Buff Service & Supply Co., a partnership composed of A. N. Cooke and H. L. Steed). U. S. 2,333,785, Nov. 9, 1943 (March 1, 1943).

Cam-grinding machine. C. W. LANG (Enterprise Engine & Foundry Co.). U. S. 2,334,938, Nov. 23, 1943 (March 29, 1943).

Centerless grinder work support. G. W. RAUSCHENBERGER (National Steel Corp.). U. S. 2,332,528, Oct. 26, 1943 (Dec. 23, 1941).

Ceramically bonded diamond abrasive. R. H. LOMBARD (Norton Co.). Can. 415,499, Sept. 28, 1943 (May 30, 1942; in U. S. June 19, 1941). G.M.H.

Coated abrasive. N. E. OGLESBY, C. F. REILLY, AND V. W. GILBERT (Behr-Manning Corp.). U. S. 2,333,034, Oct. 26, 1943 (Feb. 6, 1937). N. E. OGLESBY (Behr-Manning Corp.). U. S. 2,333,035, Oct. 26, 1943 (Feb. 6, 1937; Nov. 8, 1939).

Coated abrasive article. N. P. ROBIE (Carborundum Co.). Can. 415,016, Sept. 7, 1943 (Feb. 3, 1942). G.M.H.

Contour-grinding machine. C. J. CLARK. U. S. 2,333,985, Nov. 9, 1943 (June 18, 1942).

Crank grinder. H. A. GOOD (Landis Tool Co.). U. S. 2,335,241, Nov. 30, 1943 (July 29, 1941).

Cup-shaped abrasive wheel and method of making. EDWARD VAN DER PYL (Norton Co.). U. S. 2,334,049, Nov. 9, 1943 (Dec. 1, 1941).

Cutter grinder. R. A. FRANZEN (Mechanical Die and Tool Co., Inc.). U. S. 2,332,510, Oct. 26, 1943 (May 28, 1940).

Cylinder-grinding tool. F. G. WACKER (Automotive Maintenance Machinery Co.). U. S. 2,331,523, Oct. 12, 1943 (Nov. 24, 1941).

Device for cleaning stili tubes, etc. NORTON GRINDING WHEEL CO., LTD. Brit. 556,514, Oct. 20, 1943 (Oct. 18, 1941).

Diamond abrasive article. H. R. HOUCHINS (Carborundum Co.). U. S. 2,334,266, Nov. 16, 1943 (Feb. 2, 1939).—An abrasive article containing abrasive grains comprising diamonds and a vitrified glass bond therefor containing, in combined form, approximately 70 to 80 SiO_2, 11 to 20 B_2O_3, 3 to 13 Na_2O, and 2 to 10% Al_2O_3, the bond being present in an amount such that the article has a porous type of structure and relatively hard characteristics.

Diamond abrasive article. P. L. KUZMICK (J. K. Smit & Sons, Inc.). U. S. 2,333,429, Nov. 2, 1943 (April 6, 1942).

Diamond tools for dressing, abrasive, polishing, etc., and the manufacture thereof. F. C. JEARUM. Brit. 556,668, Oct. 27, 1943 (April 7, 1942).

Edge-grinding machine for strip material. P. E. CARRICK. U. S. 2,332,890, Oct. 26, 1943 (May 19, 1943).

Filled abrasive article and filler for it. L. P. JACKSON. U. S. 2,333,480, Nov. 2, 1943 (Feb. 22, 1943).—An abrasive article impregnated with a filler comprising sulfur and chlorinated diphenyl.

Granular coated article. H. P. KIRCHNER (Carborundum Co.). Can. 415,467, Sept. 28, 1943 (Jan. 30, 1942). G.M.H.

Grinding apparatus. W. J. GREENLEAF (McCrosky Tool Corp.). U. S. 2,333,101, Nov. 2, 1943 (July 15, 1941).

Grinding head. LOWELL STETLER (Samuel T. Haas). U. S. 2,332,676, Oct. 26, 1943 (Aug. 4, 1940).

Grinding machine. J. F. STANDISH AND L. S. MACDONALD (United Shoe Machinery Corp.). U. S. 2,332,675, Oct. 26, 1943 (Aug. 15, 1940). R. E. PRICE, H. E. BALSIGER, AND M. A. HOLLENGREEN (Landis Tool Co.). U. S. 2,335,356, Nov. 30, 1943 (Feb. 28, 1940). R. H. CRAMER (General Motors Corp.). U. S. 2,333,411, Nov. 2, 1943 (April 30, 1942); divided out of U. S. 2,311,213, Feb. 16, 1943 (July 30, 1940). J. C. WILSON (Thompson Grinder Co.). U. S. 2,335,625, Nov. 30, 1943 (March 13, 1941). JONES & LAMSON MACHINE CO. Brit. 555,786, Sept. 22, 1943 (Aug. 17, 1940). Brit. 555,819, Sept. 22, 1943 (Aug. 17, 1940); divided out of Brit. 555,786. Brit. 555,820, Sept. 22, 1943 (Aug. 17, 1940); divided out of Brit. 555,786.

Grinding machine steady rest. H. A. SILVEN (Norton Co.). Can. 415,058, Sept. 7, 1943 (Nov. 2, 1942; in U. S. Nov. 19, 1941). G.M.H.

Grinding machine table positioning mechanism. H. F. WIDENER AND G. F. MUSKOVIN (Norton Co.). Can. 414,151, July 27, 1943 (Oct. 23, 1942; in U. S. Nov. 17, 1941). G.M.H.

Grinding machine with wheel-shifting means. W. F. ROSS (Fellows Gear Shaper Co.). U. S. 2,332,603, Oct. 26, 1943 (Feb. 6, 1941).

Grinding and polishing machine. JOSEF DESENBERG. Can. 414,970, Aug. 31, 1943 (Oct. 11, 1941). G.M.H.

Grinding tools, such as cutting tools, and a machine therefor. W. M. BURA. Brit. 556,527, Oct. 20, 1943 (March 31, 1941).

Grinding wheel. R. H. LOMBARD AND L. H. MILLIGAN (Norton Co.). U. S. 2,332,241, Oct. 19, 1943 (Dec. 6, 1941).—An abrasive article comprising oxidizable abrasive grains bonded with a vitrified borosilicate bond including 40 to 70% silica, 2 to 20% of oxide selected from the group consisting of zirconia and titania, not more than 30% of alumina, 2 to 15% of alkaline-earth oxide, 5 to 25% of boron oxide, and 0.5 to 5% of alkali metal oxide, all percentages being by weight on the entire vitrified bond.

Grinding wheel truing apparatus. C. G. FLYGARE AND F. T. MACKENZIE (Norton Co.). U. S. 2,335,207, Nov. 23, 1943 (May 5, 1942).

Grinding wheel truing mechanism. L. M. DAVIS (Jones & Lamson Machine Co.). U. S. 2,332,560, Oct. 26, 1943 (July 12, 1941).

Honing machine. C. A. FULMER. U. S. 2,334,758, Nov. 23, 1943 (Jan. 30, 1942).

Honing tool. M. N. PRANGE. U. S. 2,334,838, Nov. 23, 1943 (April 13, 1942).

Machine for sharpening handsaws. B. G. DAGGETT. U. S. 2,333,298, Nov. 2, 1943 (July 31, 1940).

Machines for regrinding worn crankshafts. V. J. PRINCE. Brit. 556,274, Oct. 13, 1943 (March 24, 1942).

Magnetic chuck. J. T. BEECHLYN (O. S. Walker Co., Inc.). U. S. 2,333,230, Nov. 2, 1943 (Dec. 24, 1940).

Making diamond disks. GEORGE CROMPTON, JR. (Norton Co.). U. S. 2,332,505, Oct. 26, 1943 (Nov. 19, 1941).

Manufacture of abrasive materials. R. L. MELTON AND R. C. BENNER (Carborundum Co.). U. S. 2,334,572, Nov. 16, 1943 (Dec. 29, 1941).

Method and apparatus for forming abrasive articles. CARBORUNDUM CO. Brit. 556,023, Sept. 29, 1943 (Nov. 24, 1941).

Metal-bonded abrasives and their manufacture. CARBORUNDUM CO. Brit. 556,322, Oct. 13, 1943 (March 27, 1941).

Mounting means for tools for dressing abrasive wheels, etc. F. C. JEARUM. Brit. 556,675, Oct. 27, 1943 (June 19, 1942).

Peripheral diamond grinding wheel. EDWARD VAN DER PYL (Norton Co.). U. S. 2,334,048, Nov. 9, 1943 (Dec. 1, 1941).

Polishing wheel and method of treatment. R. V. TWYNING (J. C. Miller Co.). U. S. 2,331,583, Oct. 12, 1943 (Nov. 14, 1941).—The method of treating a fabric wheel which consists in impregnating the fabric of the wheel with tricresyl phosphate carried suspended in a water solution of silicate of soda and thereafter baking the wheel at a temperature and for a time sufficient to expel the water.

Profile-grinding machine. J. W. EKSTEDT (General Tool & Mfg. Co.). U. S. 2,331,381, Oct. 12, 1943 (Oct. 15, 1941).

Resin and abrasive body. S. S. KISTLER (Norton Co.). U. S. 2,332,235, Oct. 19, 1943 (Oct. 29, 1941).

Saw-sharpening machine. J. I. UNDERWOOD. U. S. 2,334,136, Nov. 9, 1943 (Sept. 4, 1942).

Screw thread lapping device. A. M. DRAKE (Niles-Bement-Pond Co.). U. S. 2,335,745, Nov. 30, 1943 (Nov. 27, 1941).

Siliconized silicon carbide. A. H. HEYROTH (Carborundum Co.). Can. 414,263, Aug. 3, 1943 (June 10, 1938). G.M.H.

Steady rest. R. E. BAUER (Ex-Cell-O Corp.). U. S. 2,332,837, Oct. 26, 1943 (March 12, 1941).

Surface grinder spindle bearing. W. G. BALDENHOFER (Thompson Grinder Co.). U. S. 2,334,238, Nov. 16, 1943 (Dec. 22, 1941; Aug. 3, 1942).

Tool-grinding machines. MAGERLE AKT.-GES. Brit. 555,744, Sept. 15, 1943 (March 15, 1941).

Trimmer for abrasive disks. L. A. SMITH. U. S. 2,333,958, Nov. 9, 1943 (July 23, 1942).

Truing of thread-grinding wheels and tools therefor. L. E. VAN MOPPES, E. M. VAN MOPPES, S. W. GRIFFIN, AND N. R. SMITH. Brit. 556,644, Oct. 27, 1943 (April 10, 1942).

Vitrified diamond grinding wheel. R. H. LOMBARD (Norton Co.). Can. 415,498, Sept. 28, 1943 (May 1, 1942; in U. S. May 10, 1941). G.M.H.

Wheel dresser for gear-grinding machines. CARROLL KNOWLES AND A. L. WILDER (Niles-Bement-Pond Co.). U. S. 2,335,341, Nov. 30, 1943 (Aug. 1, 1942).

Art and Archeology

Feet of clay. BERNICE K. PLATT. *Amer. Home*, **30** [5] 72 (Oct., 1943).—P. tells the story of Jean Manley, a young Hollywood artist, Canadian born, who molds clay figures, etc., that add beauty to the home. Kinds of models are discussed in regard to color, style, and the manner in which they can be used, e.g., as color notes in dark corners and in shallow bowls with flower arrangements. A.G.B.

New Jersey glauconite as a major constituent of some brown glazes. GIRARD W. PHELPS. *Bull. Amer. Ceram. Soc.*, **22** [11] 374 (1943).—3 references.

Soviet dig near Samarkand. HENRY FIELD AND EUGENE PROSTOV. *Asia and Americas*, **43**, 529–31 (1943).—At Tali Barzu are six ancient cultural layers. Layer I (600 B.C.) has pottery like the stemmed red mat engobe vases of Tepe Hissar. Layer II (500 B.C.) has a large fortress; the pottery has ribbon ornament and handles depicting animals; figurines have the Scythian costume. Layer III follows Alexander's conquest; it is not so rich and shows the Greek influence. Layer IV (A.D. 200) is associated with the invasion of nomads from more easterly Asia. Here were found Buddhist images, the earliest Soghdian

writing on a sherd, and silver coins. Layer V shows buildings of large clay slabs and Sasanian ornamentation on clay and metal. Layer VI (A.D. 700) has the first glazed pottery. See "Excavations . . . ," *Ceram. Abs.*, **20** [11] 256 (1941). W.D.F.

BOOK

Pottery and Porcelain of Swansea and Nantgarw. E. MORTON NANCE. B. T. Batsford, Ltd., London, 1943. Price £7 7s. Reviewed in *Jour. Roy. Soc. Arts*, **91** [4647] 541–42 (1943).—Little information about Welsh potteries has been available to collectors, but this recent book gives their history, showing 1700 specimens, the majority from the author's own collection. The making of earthenware on an industrial scale began first in Swansea. The earliest illustration, a lead-glazed flask (1768), shows that Wales factories, like others, began by making delftware. From coarse stoneware, the potters advanced to creamware, either painted or transfer decorated, printed in blue. The creamware resembled Wedgwood's queen's ware. The second half of the book deals with the manufacture of porcelain, the most prominent name being that of Billingsley. After returning to paint on china, B. became the first user of a new method of modeling flowers. His skill, from 1795 on, greatly improved the porcelain products of the Pinxton factory. The book fills a gap in the history of ceramic art, not only for connoisseurs but also for the student of social life in the Napoleonic period. K.R.

PATENTS

Glass tumbler design. E. S. LYNCH. U. S. 136,520, Oct. 19, 1943 (Feb. 1, 1943).

Ink bottle. EDWARD TERRELL. Can. 414,404, Aug. 10, 1943 (April 17, 1939; in Great Britain May 2 and Oct. 15, 1938). G.M.H.

Manufacture of ceramic buttons, etc. ALTHAM COLLIERY CO. (1924), LTD. (trading as Accrington Brick & Tile Co.), AND J. S. ROBINSON. Brit. 555,839, Sept. 22, 1943 (March 24, 1942).

Manufacturing decorated chinaware and pottery. G. A. BAUER. U. S. 2,334,307, Nov. 16, 1943 (May 6, 1941).—Providing a jigger mold with an intaglio design in its molding face.

Method and apparatus for stenciling upon articles. J. C. SMITH, deceased, by G. H. Campbell and Mary B. Stevenson, executors (Solar Laboratories). U. S. 2,335,-461, Nov. 30, 1943 (Oct. 14, 1940).

Milk bottle design. E. H. PIHLSTROM. U. S. 136,-514 and 136,515, Oct. 19, 1943 (July 26, 1943).

Milk bottle design. WILLIAM A. CRAWFORD. Can. 13,492, July 8, 1943. G.M.H.

Producing multicolored pottery. SHERIDAN HIGGINS. U. S. 2,332,447, Oct. 19, 1943 (Dec. 26, 1939).—The process of producing pottery that comprises forming a half-disk of plastic clay having a color pattern extending from face to face, severing the half-disk along a medial plane parallel to its two faces, thereby producing two half-disks of identical color pattern, and adhesively joining the two half-disks along their diametrical edges in a manner to match the identical color patterns on the half-disks.

Vase design. BERNADI & NIERI. Can. 13,491, July 2, 1943. G.M.H.

Cements

Aluminous cement. G. A. ASHKENAZI. *Pit & Quarry*, **33** [11] 86–89 (1941).—A. reviews the development of fused cement. A material suitable for its manufacture is bauxite. The early strength of fused alumina cement is due to aluminates. The absence of calcium hydrate makes it immune to attack by sulfate-containing waters. Results of comparative tests on aluminous cement show that (1) it generates a considerable amount of heat of hydration; (2) it hardens at temperatures below the freezing point; (3) high dry heat does not affect the binding properties; and (4) it differs substantially from Portland cement. Types of kilns used in the manufacture of aluminous cements are listed. Bibliography. M.R.

Analysis of manganese Portland cements. ANON. *Pit & Quarry*, **33** [9] 67–68 (1941).—Ammonium persulfate (10%) is used to separate the manganese. See "Chemical . . .," *Ceram. Abs.*, **21** [9] 184 (1942). M.R.

Analyze heat's effect on cement clinker at Bureau of Standards. ANON. *Pit & Quarry*, **33** [7] 53 (1941).—Quantitative microscopic analyses of Portland cement clinkers were made to study clinker structure. Ten clinkers were reheated and cooled at various rates and then examined microscopically. The resulting data will be of much value. M.R.

Blasting rings from rotary kilns. RALPH GIBBS. *Rock Products*, **46** [8] 96, 98, 100 (1943).—G. describes the Cardox-Cliffe method for blasting out rings in rotary kilns. It was found satisfactory. B.C.R.

Calcined clay or Surkhi as pozzuolana. C. A. R. KHAN AND L. C. VERMAN. *Bulls. Indian Ind. Research Bur., Govt. India*, No. 24 (1941); abstracted in *Cement, Lime & Gravel*, **17** [9] 300–301 (1943).—Calcined brick finely ground and mixed with lime is used as a substitute for Portland cement. V.R.E.

Calcining Portland cement. M. H. E. W. LUTZ. *Cement & Lime Manuf.*, **13** [10] 181–82 (1940).—A reaction between calcium carbonate and the clay takes place before the formation of free lime. Between 900° and 950°C., after about one half of the calcium carbonate calculated as oxide has reacted, the free lime content increased rapidly. At about 20 ft. from the wet end of a rotary kiln (about 60 ft. long), the reaction between chalk and clay becomes marked; it is there that cement formation starts. R.W.McA.

Cement dispersion. E. W. SCRIPTURE, JR. *Pit & Quarry*, **36** [2] 75 (1943).—Concrete construction is being speeded up through cement dispersion, a new principle for the improvement of concrete and mortar. The action of the dispersing agent, its effect on concrete, and the results of application are discussed. Dispersion of cement particles increases placeable concrete (with less water), increases fattiness, reduces segregation and bleeding, increases water retentivity, reduces shrinkage before hardening, and effects greater economies. The results of the dispersing action (on hardened concrete) are increased durability, increased water tightness, higher strength, lower volume change, lower permeability, and greater uniformity. M.R.

Ceramic signposts to lime development. W. G. BAUER. *Pit & Quarry*, **34** [11] 71–75 (1942).—B. shows how the lime industry may profitably study the other branches of the ceramic industry. Processes in use elsewhere should be adapted to the lime industry. M.R.

Closed-circuit finish grinding, unit-firing system serve Lawrence plant at Siegfried. ANON. *Pit & Quarry*, **34** [5] 52–53 (1941).—The installation of direct-firing coal mills on some of the kilns of the Lawrence Portland Cement Co. at Siegfried, Pa., is discussed. M.R.

Density of raw-material slurry. W. R. BENDY. *Pit & Quarry*, **34** [2] 34–36 (1941).—B. discusses a method for determining the density of wet slurry without drying. Diagrams of apparatus are given, and four tables show (1) component weight of the slurry, (2) multiplying factors to convert the weight of the dry raw material in barrels of clinker, (3) barrels of clinker per cubic foot of slurry, and (4) pressure, in pounds per square inch, per foot of head of slurry. M.R

Determining the heat evaluation of cement. A. TOKATA. Presented at meeting of Japanese Portland Cement Engineers; abstracted in *Cement & Lime Manuf.*, **14** [9] 157–60 (1941).—The Thermos flask method of measuring the heat evolution of Portland cement is described as a basis for calculating the heat of hydrations It is imperative for commercial use in large installation.

that cement have a low velocity of heat evolution. Observations on dams under construction show that heat evolution reaches its maximum within seven days. R.W.McA.

Doubling both output and efficiency of rotary lime kilns. T. C. TAYLER. *Pit & Quarry*, **34** [5] 55–56 (1941).—It is claimed that 70% of the heat of the fuel used in a rotary lime kiln is wasted. Increasing the effective fuel to 60% may be brought about by installing (1) a lime cooler and (2) a heat exchanger or preheater. Heat from the cooling lime goes back into combustion, and heat from the stack gases preheats the stone entering the kiln. M.R.

Effect of added materials on properties of Portland cement. G. L. KALOUSEK. *Pit & Quarry*, **36** [3] 67–70 (1943).—K. summarizes three previously published papers (see *Ceram. Abs.*, **22** [5] 67; [6] 98 (1943)). M.R.

Effect of alkalis on concrete. G. ASH. *Pit & Quarry*, **34** [4] 40–42 (1941).—The alkali contents of cements range from slightly less than 0.50 to 1.6%. Of 38 cements tested, only 7 brands showed 0.50 or less, the remainder containing 0.59 to 1.24% with an average of 0.83%. The action of an alkali depends to some extent on the aggregate used. Even small amounts of alkali will cause concern when used with rock and minerals such as andesite, certain cherts, feldspars, etc. A discussion of chemical reactions is given with literature references. M.R.

Effect of storage on Portland cement. K. WATANABE. Presented at meeting of Japanese Portland Cement Engineers; abstracted in *Cement & Lime Manuf.*, **14** [11] 187–90 1 941).—Normal, rapid-hardening, and high siliceous cements were stored for 9 months and observations were made. Increases in setting time occurred with all cements up to 9 months. Workability decreased after 1 month's storage for the first two cements but increased for the siliceous cement up to 9 months. R.W.McA.

Fuel consumption of rotary cement kilns. S. GOTTLIEB. *Cement & Lime Manuf.*, **15** [6] 77–80 (1942).—While trends in the cement industry have shown a preference for developed rotary kilns, the shaft kiln has also reached a high state of development in the Hauenshild & Andreas kilns. Heat balances for the two processes are as follows:

Heat Supplied

Rotary kiln	Cal. per kgm. clinker	Shaft kiln	Cal. per kgm. clinker
Oil (16.5% used; cal. value 9700)	1600.0	Coal (14.6% used; cal. value 7000)	1020.0
Air (with 10% excess at 30°C.)	16.5	Air (at 30°C.)	8.3
Slurry at 25°C.	35.0	Raw mix at 30°C.	9.8
	1651.5		1038.1

Heat Used and Lost

Rotary kiln	Cal. per kgm. clinker	Shaft kiln	Cal. per kgm. clinker
Heat for burning clinker	448.0	Heat for burning clinker	448.0
Waste gases at 160°C.	105.5	Waste gases at 100°C.	63.1
Excess air	18.0	Excess air	11.1
Water (43%) from slurry	799.0	Water (15%) from briquettes	172.0
Moisture from oil	5.0	Moisture from coal	4.0
Waste heat of clinker leaving at 150°C.	28.5	Waste heat of clinker at 180°C.	34.2
Radiation and other losses	247.5	Radiation and other losses	305.7
	1651.5		1038.1

R.W.McA.

Heat recovery with the air-quenching cooler. A. W. CATLIN. *Pit & Quarry*, **34** [8] 39, 42 (1942).—C. discusses the principles involved in the recovery of heat given off by cooling clinker from 2500° to 800°F. This is a recovery of 74% of the initial heat. Two graphs show the heat recovery by percentage and by B.t.u. per pound. M.R.

Insoluble residue in cement and its effect on the strength of concrete. A. J. BLANK. *Pit & Quarry*, **34** [5] 66–67 (1941).—B. made tests using five brands of Portland cement made in Mexico, the Atoyac type of special cement, and the Plastocement type of masonry cement. Laboratory tests for Portland cement are discussed. Insoluble-residue tests were made on the mixture of lime and siliceous material (1) prior to hydration, (2) soon after hydration and prior to moist-heat grinding, (3) on the product coming from the tube mill after moist-heat grinding, (4) on neat test specimens which had been stored under water for 2 years, (5) on similar specimens after 3 years under water, and (6) on similar specimens after 4 years under water. Results of the tests are shown in tables. M.R.

New lime-putty plant approaches ideal as conceived by its inventor. ANON. *Pit & Quarry*, **33** [11] 54–58 (1941).—A brief history of the lime-putty industry inaugurated by Hayden Brooks in 1919 is given. In his new plant all possible refinements have been included. The plant equipment is discussed. Illustrated. M.R.

Permanente—newest name in the American cement industry. W. E. TRAUFFER. *Pit & Quarry*, **33** [6] 27–59 (1940).—A plant in Los Altos, Calif., was built to produce 5,800,000 barrels of low-heat cement for Shasta Dam. Designed for a capacity of 7000 barrels daily, it has from the beginning exceeded that figure. T. gives a layout of the plant, flow sheets, and tabular analysis of the cement, sugar-rock, crushed stone, and lime plants. The various plants making up the entire development are discussed, with details of equipment, capacities, etc. M.R.

Portland cement—review of 1941. ANON. *Pit & Quarry*, **34** [7] 65–72 (1942).—Portland cement production for 1941 was estimated at 164,000,000 barrels. The 1942 output is expected to be greater. Equipment which was added to the producing facilities of more than 18 Portland cement plants during 1941 is discussed. M.R.

Rotary lime kiln operating technique. W. R. CLIFFE. *Pit & Quarry*, **33** [12] 42–44 (1941).—C. compares the typical 150- or 175-ft. kiln with the newer and longer rotary kiln and discusses the advantages and disadvantages of heat-exchanger systems. The rotary kiln is but one of many factors that contribute to the effective production of pebble lime. Other factors are proper draft control, feed uniformity, recuperators, heat exchangers, refractory refinements, insulation, rotation speed, combustion control, air and gas velocities, heat recovery, instrumentation, and intelligent operation. M.R.

Tentative procedure for determining the relative plasticities of cements. E. W. REED-LEWIS. *Pit & Quarry*, **33** [10] 48–50 (1941).—The mobility gauge is described, and a summary of procedure and practical applications relating to the procedures followed in measuring the properties of cements for their plasticity are given. A standard-mobility test involves molding and the use of the mobility gauge. Tests for "zero bleeding" take in mixing, molding, and zero bleeding. Symbols and computations used in recording the results are listed. M.R.

Two old rotary kilns joined to make one 400-ft. unit at Peerless plant. ANON. *Pit & Quarry*, **34** [8] 34–36 (1942).—The Peerless Cement Corp. at Port Huron, Mich., made a 400-ft. kiln out of two 200-ft. kilns. The plant equipment is described, and the new kiln, its efficiency, and its economy of operation are discussed. M.R.

Vertical kiln of new design calcines smaller sizes of crushed limestone. T. R. ELLERBECK. *Pit & Quarry*, **34** [11] 55–58 (1942).—E. describes the Ellernan calciner, its operational characteristics, and its design features. The calciner has both the simplicity of operation of a rotary kiln and the heat efficiency of the shaft kiln and adapts itself to the needs of both large and small producers of lime products. Illustrated. M.R.

PATENTS

Calcined gypsum plaster. G. D. KING AND M. C. DAILEY (Canadian Gypsum Co., Ltd.). Can. 414,562, Aug. 17, 1943 (Nov. 21, 1938; in U. S. Nov. 26, 1937). G.M.H.

Calcium sulfate plaster. VICTOR LEFEBURE (Imperial Chemical Industries, Ltd.). Can. 415,628, Oct. 5, 1943 (July 8, 1941). G.M.H.

Flotation of cement minerals. L. J. CHRISTMANN AND S. E. ERICKSON (American Cyanamid Co.). U. S. 2,335,485, Nov. 30, 1943 (June 20, 1940).—The improvement in the recovery of cement-rock values by froth flotation processes which comprises subjecting an aqueous pulp of cement rock to froth flotation in the presence of a cement rock ore promoter of the group consisting of higher fatty acids, mixtures of higher fatty acids, and soaps of such acids, the promoters being diluted with at least one aliphatic alcohol, the alcoholic content of the promoter being from about 9% to not more than about 20%.

Gypsum composition. M. C. DAILEY (Canadian Gypsum Co., Ltd.). Can. 414,431, Aug. 10, 1943 (Jan. 10, 1941; in U. S. Jan. 18, 1940). G.M.H.

Reinforced ceramic material. J. R. PARSONS (Canadian Gypsum Co., Ltd.). Can. 414,563, Aug. 17, 1943 (May 4, 1939; in U. S. May 9, 1938). G.M.H.

Reinforced structural element. J. K. DUNCAN AND G. L. PHELPS (Canadian Gypsum Co., Ltd.). Can. 414,564, Aug. 17, 1943 (April 12, 1941; in U. S. May 2, 1940). G.M.H.

Enamel

Chart data on molds and core surface behavior at pouring temperatures. H. W. DIETERT. *Amer. Foundryman*, **5** [10] 2–5 (1943).—D. presents up-to-date information, in outline form, on mold and core surface behavior at metal pouring temperatures with regard to physical properties as determined with a dilatometer. The properties considered are spalling, hot deformation, volume change, heat conductivity, glazing, hot strength, collapsibility, and hot permeability. He tells what factors produce these properties, how they may be reduced or retarded, and defects caused by them. M.A.S.

Control of enamels. A. J. D. BLACK. *Proc. Inst. Vitreous Enamellers*, **5**, 139–57 (1939); see *Ceram. Abs.*, **19** [9] 210 (1940). A.B. & V.R.E.

De-enameling of vitreous enameled steel and sheet iron. N. L. EVANS. *Proc. Inst. Vitreous Enamellers*, **6**, 36–65 (1940); see *Ceram. Abs.*, **19** [11] 253 (1940). A.B.

Developments in theory and practice of magnesium alloy sand casting. GERALD GOLDEN. *Amer. Foundryman*, **5** [10] 13–20 (1943).—G. reviews the developments in magnesium alloy sand casting, including (1) history, (2) extraction, (3) sand agents, (4) molding sands, (5) melting techniques, (6) care of crucibles, (7) function of fluxes, (8) pouring practice, (9) core practice, (10) heat-treatment, (11) fire hazards, and (12) inspection. M.A.S.

Enameled Utensil Manufacturers' Council. ANON. *Bull. Amer. Ceram. Soc.*, **22** [11] 387–88 (1943).

Enameling shop troubles. A. J. BIDDULPH. *Proc. Inst. Vitreous Enamellers*, **5**, 192–201 (1939); see *Ceram. Abs.*, **19** [9] 210 (1940). A.B.

Enameling troubles. S. W. VICKERY. *Proc. Inst. Vitreous Enamellers*, **5**, 105–11 (1939); see *Ceram. Abs.*, **19** [6] 134 (1940). A.B. & V.R.E.

Foundry and enamel practice as applied to cast iron. G. M. LOGAN. *Proc. Inst. Vitreous Enamellers*, **5**, 112–38 (1939); see *Ceram. Abs.*, **19** [9] 210 (1940). A.B. & V.R.E.

Influence of climatic conditions on enameling. B. DEUTSCH. *Proc. Inst. Vitreous Enamellers*, **6**, 15–35 (1940); see *Ceram. Abs.*, **20** [1] 9 (1941). A.B.

Investigation and modern ideas on enamel control. G. H. ABBOTT. *Proc. Inst. Vitreous Enamellers*, **5**, 158–91 (1939); see *Ceram. Abs.*, **19** [9] 210 (1940). A.B.

Scientific aids to control in vitreous enameling. J. G. PEARCE AND G. T. O. MARTIN. *Proc. Inst. Vitreous Enamellers*, **5**, 25–69 (1939); see *Ceram. Abs.*, **18** [11] 292 (1939). A.B. & V.R.E.

Sources of hydrogen in steel and means for its elimination. CARL A. ZAPFFE. *Metal Progress*, **43** [3] 397–401 (1943).—The principal source of hydrogen for most steels is water, whether liquid, vapor, or combined, as in iron rust. All the common defects in or on steel caused by hydrogen are effected only by portions of that gas entrapped under surprising pressures. For a given type of defect, there must be a critical pressure and volume of hydrogen. To avoid any one type of defect, it is necessary to remove only a critical quantity of the gas. In some cases the hydrogen derived from steel has only a minor role as compared with that obtained from pickling, cathodic electrolysis, carburizing with H_2-steeped compounds, and annealing in reducing atmospheres containing hydrogen. In electroplating, substitution of anodic cleaning for pickling or cathodic cleaning is helpful. In enameling, heating the slip to remove some of the water and controlling the furnace atmosphere with respect to hydrogen-containing gases are beneficial. In the thermal treatment of steel, the best temperature is slightly below the solubility change at the γ to α transformation; a lower temperature must be maintained for porous steel, especially weld metal. See "Defects. . .," *Ceram. Abs.*, **22** [5] 67 (1943); "Fish-eyes. . .," *ibid.*, p. 68. B.C.R.

PATENTS

Enameling. C. H. ZWERMANN, JR. U. S. 2,332,423, Oct. 19, 1943 (Sept. 30, 1939).—The method of making enamel comprising the steps of grinding vitrified frit to produce a product comprising predominantly particles of a size less than 4 microns, intimately mixing finely divided opacifier, and heating the mixture sufficiently to merely soften the frit particles to permit the surface tension thereof to reduce the over-all size thereof. **U. S. 2,332,424,** Oct. 19, 1943 (Sept. 30, 1939).—The method of producing titanium dioxide enamel comprising intimately mixing finely divided titanium dioxide in the anatase form with vitrified frit comprising predominantly particles of a size of 4 microns or less and heating the mixture at a temperature of approximately 1280°F. for approximately 1 hr.

Enameling composition. H. F. STALEY AND R. R. DANIELSON (Metal & Thermit Corp.). U. S. 2,334,043, Nov. 9, 1943 (Sept. 7, 1940).—An opaque enameling or glazing composition capable of producing a finished enamel having commercially acceptable reflectance upon firing and comprising a fusible enamel frit having a molecular ratio of silica to the sum of the basic monoxide equivalents available for combining with the silica of up to but not exceeding 1:1, an aluminum oxide content of at least about 2% by weight, and a zirconium oxide content ranging from about 8 to 12% by weight, the composition when fired producing an opaque coating of high gloss, stability, and reproducibility having reflectancies within the range of about 78 to 87%.

Enamelware manufacture. C. J. KINZIE AND C. H. COMMONS, JR. (Titanium Alloy Mfg. Co.). Can. 414,341, Aug. 3, 1943 (Jan. 12, 1942; in U. S. Nov. 10, 1938, and April 11, 1941). G.M.H.

Glass-lined head for tanks. F. W. LAUCK (A. O. Smith Corp.). U. S. 2,335,153, Nov. 23, 1943 (April 25, 1942).

Opaquing agent for vitreous enamels. H. C. KREMERS AND L. A. BATEMAN (Harshaw Chemical Co.). U. S. 2,332,236, Oct. 19, 1943 (Aug. 20, 1940).—A process of producing a ceric oxide of superior opaquing properties in vitreous enamels comprising calcining a cerium oxide, NaOH, and a phosphate, the cerium oxide and NaOH being in proportion to form $Na_2O \cdot CeO_2$ ±15 mol % and the

phosphate radical being present to the extent required to yield phosphate radical to the extent of 0.2 to 0.8% of the CeO_2 in the final product, the temperature of calcination being 700° to 900°C. and the time from ½ hr. to 1½ hr., and decomposing the calcination product by the action of water.

Sandblast nozzle. W. J. McDERMOTT (A. O. Smith Corp.). U. S. 2,333,264, Nov. 2, 1943 (Feb. 21, 1942).

Glass

Bausch & Lomb Optical Co. celebrates 90th anniversary and record production of optical glass. ANON. *Bull. Amer. Ceram. Soc.*, **22** [12] 416 (1943).

Behavior of glazing material subjected to explosion. F. W. ADAMS. *ASTM Bull.*, No. 122, pp. 15–23 (May, 1943); see "Effect . . . ," *Ceram. Abs.*, **22** [2] 30 (1943). B.C.R.

Calculation of batch and glass compositions. BRUNO SCHWEIG. *Glass*, **20** [3] 61–64, 67; [4] 87–89; [5] 115–19; [6] 143–45, 155 (1943).—The chemistry of glassmaking and methods of calculating compositions are discussed, including calculations covering losses due to volatilization and to corrosion. B.C.R.

Coating prevents flying glass. ANON. *Ind. Finishing*, **18** [5] 50 (1942).—Tests have shown that ordinary window glass coated with a material marketed as Roxaneal is nearly as resistant to shattering as regular safety glass. Roxaneal is waterproof and can be brushed or sprayed. See "Shatter- . . . ," *Ceram. Abs.*, **22** [3] 51 (1943). C.W.

Conference on postwar education and training for the glass industry: Introductory address. E. ENGLISH. *Jour. Soc. Glass Tech.*, **27** [120] 48–53P (1943). **Youth and industry.** GEORGE CHESTER. *Ibid.*, pp. 54–62P. **Some aspects of research.** J. I. O. MASSON. *Ibid.*, pp. 63–71P. **Education in the glass industry with special reference to the Glass Container Section.** EDWARD MEIGH. *Ibid.*, pp. 72–94P. **Appendix.** E. J. GOODING. *Ibid.*, pp. 95–101P. **Education and training for the glass industry.** W. H. S. CHANCE. *Ibid.*, pp. 102–107P. **Notes on education for the glass industry with particular reference to education for foremanship.** JAMES MEIKLE. *Ibid.*, pp. 108–12P. **Postwar education and training for the glass industry.** EDWARD WALKER. *Ibid.*, pp. 113–22P. **Training of industrial designers.** JAMES HOGAN. *Ibid.*, pp. 123–27P. **Lessons of the Conference.** W. E. S. TURNER. *Ibid.*, pp. 128–30P. R.H.B.

Constitution of glass: I. BRUNO SCHWEIG. *Glass*, **20** [7] 173–74 (1943).—S. discusses the historical facts concerning the early development of the atomic theory. **II and III.** *Ibid.*, [8] 200–202; [9] 227–29, 236.—S. discusses the structure of atoms. B.C.R.

Effect of shape on the thermal endurance of cylindrical glass containers. J. B. MURGATROYD. *Jour. Soc. Glass Tech.*, **27** [121] 77–93T (1943).—Theoretical investigations on the effect of shape on the stress systems set up by thermal gradients are discussed, and the results are applied to the problem of the thermal endurance of cylindrical glass containers. The stress systems at the mouth of a container and at the junction of the cylinder and the base are considered, although insufficient theoretical knowledge and experimental data permit only a qualitative assessment of their values. The predictions from theoretical work are compared with experimental results of tests on glass containers, and a good agreement is found. See *Ceram. Abs.*, **22** [10] 170 (1943). R.H.B.

Electric lehrs for annealing glass. P. SCHLENKER. *Brown Boveri Rev.*, **29**, 178–79 (June-July, 1942); *Science Abs.–B*, **46**, Abs. No. 1770 (Aug., 1943).—To avoid shattering, glass objects must be annealed to remove internal strains, a process which should consist of gradual equalization of the internal tensions in the glass under temperatures which are the same for the whole piece, uniform cooling of the whole article down to the limit temperature of plastic deformation, and, finally, cooling down to ordinary temperatures. The whole process requires 5 to 8 hr., and hence large lehrs are essential. Electrical heating is suitable for the purpose, as it is possible to employ a predetermined temperature curve. Two electrically heated lehrs are described in which the glassware is carried on conveyer grids consisting of perforated metal sheeting. H.K.R.

Experimental studies of the temperature gradients in glasses of various colors. H. H. HOLSCHER, R. R. ROUGH, AND J. H. PLUMMER. *Jour. Amer. Ceram. Soc.*, **26** [12] 398–404 (1943).—10 references, 10 figures.

Edmond Feil, the first successful manufacturer of optical glass in America. W. H. S. CHANCE. *Jour. Soc. Glass Tech.*, **27** [121] 113–32T (1943).—A contribution to the general history of optical glass manufacture is presented. Edmond Feil was a great-grandson of Pierre Louis Guinard (1748–1824), the inventor of the modern process of manufacturing optical glass. He spent the earlier part of his working life in Paris in the optical-glass works of his father, Charles Feil; he was associated with Chance Brothers & Co. for a brief period commencing March, 1887, and later went to the U.S.A. where, in 1893, he was engaged to superintend the optical glass factory of Macbeth & Co., of Pittsburgh, Pa. Between 1897 and 1902 he was employed by the Manhattan Optical Co. at Cresskill, N. J. An account of his optical-glass formulas and procedures, as communicated to Chance Brothers & Co., is given. R.H.B.

Fiberglas as an electrical insulation. L. T. RUSSELL. *Wire & Wire Products*, **18** [10] 624–26 (1943).—The manufacture and the properties of Fiberglas are discussed, and some of its 380 products are listed. B.L.

Fibrous glass electrical insulation. A. M. ROBERTSON. *Glass*, **20** [6] 151 (1943).—Fibrous glass for electrical insulation has an apparent density of 80 lb. per cu. ft. Its nonhygroscopic property makes it well suited for marine use where cotton fiber may absorb as much as 6% moisture. In addition, it allows higher operating temperatures than other types of insulation. B.C.R.

Frictional phenomena: (C, Solids) XI. ANDREW GEMANT. *Jour. Applied Physics*, **13**, 688–96 (1942).—The general features of plastic phenomena in solids are described, and various theories giving theoretical and pictorial explanations of plastic processes are sketched, including the Prandtl model, Smekal's flaw emphasis as extended by Becker and later Orowan, and the theory of Polyani and G. I. Taylor which bears a closer relation to physically measurable quantities. Experimental results illustrate the chief features of plastic flow in solids. **XII.** *Ibid.*, pp. 732–44.—The technical importance of the plastic properties of solids is shown in the flow of glasses in the 400° to 600°C. range, important from the standpoint of annealing. For Parts **VIII–X** see *Ceram. Abs.*, **21** [11] 248 (1942); for Parts **XIII** and **XIV** see this issue, p. 25. A.P.

Fused quartz—a growing engineering material. W. M. JOHNSON. *Chem. Industries*, **53** [4] 515–16 (1943).—Fused quartz has a coefficient of expansion one-seventh that of glass, lower than any known material. It has the highest transmission of ultraviolet of any known material except crystal quartz and fluorite. Quartz transmits light between 1850 and 40,000 a.u. With quartz blocks and ring gauges it is possible to measure both sides of a processed part simultaneously for parallelism. Quartz can be spun to a fineness of 0.0001 in., making it suitable for cross hairs on instruments. It has been used to develop surface mirrors. It has a high resistivity and low dielectric losses, particularly at high temperatures. Its dielectric losses are one-eighth those of wet-processed porcelain. Due to its low affinity for moisture, its surface leakage is very small. Its compression strength is 190,000 lb. per sq. in., and its tensile strength is 7000 lb. per sq. in. Its hardness (Mohs) is 4.9, and its resistance to scratching and

weathering makes it superior to plastics. It has been used in condenser lenses to gather light from high-intensity carbon arcs placed only a few inches from the surface of the lens. It becomes ductile at 1756°C. but may be used continuously at working temperatures of 1000° or on intermittent service up to 1260°C. It is chemically resistant to all substances except alkalis, HF, and hot phosphoric acid. E.D.M.

Glass. W. M. HAMPTON AND R. E. BASTICK. *Ann. Repts. Soc. Chem. Ind. on Progress of Applied Chem.*, **27**, 174–92 (1942).—This is a review of 1942–1943 literature covering constitution, materials, melting, devitrification, furnaces, and refractories, analysis and testing, annealing, durability, and physical properties. Exhaustive references are given. R. C. PURDY

Glass fibers offer possibilities in chemical process equipment. ANON. *Chem. Industries*, **53** [4] 501 (1943).—Uses of glass fibers are listed. E.D.M.

Glass fibers reinforce plastics used in aircraft. ANON. *Science News Letter*, **44** [19] 296 (1943).—Glass fiber is now being used to reinforce plastics employed in aircraft construction. The material can be machined and has the dimension stability of metals. G.A.K.

Glass filters. ANON. *Engineering*, **156** [4055] 266–67 (1943).—Glass filters passing 120 to 160 thousand cu. ft. of air per min. are constructed so that air is passed in a horizontal direction through chambers, its passage being interrupted by filter cells inclined at an angle of 35° to the horizontal. The faces of the cells are sprayed with finely divided jets of water which retains atmospheric impurities. The elements are formed of fine glass filaments (approximately 57,000 filaments to a cell) with a total surface of about 125 sq. ft. These filters remove over 95% by weight of air-borne solid matter. G.A.K.

Glass gauges for routine inspection. ANON. *Machinery* [London], **63** [1604] 42–44 (1943).—Experiments started two years ago by the Ministry of Supply showed that only gauges of the thick taper socket type are more economical than steel gauges. Chance Bros. glass was used, and although wear was fast during the first few hundred inspections, later it was slower than with steel. A survey is given of U. S. developments on similar lines. See "Glass for precision gauging," *Ceram. Abs.*, **22** [10] 170 (1943); "Hysil . . . ," this issue. V.R.E.

Glass jewels for electrical instruments. W. PHILLIPS AND L. W. PETTITT. *Elec. Times*, **103** [2676] 120–23 (1943).—Hard borosilicate glass is eminently suitable for electrical instruments where metallic bearings, because of their high electrical conductivity, cannot be employed. The standard which such glass "jewels" must meet, as far as ability to withstand shock and vibration is concerned, is at least that of a synthetic sapphire used for the same purpose. The test is exactly the same as the National Physical Laboratory's test for determining the hardness of sapphire pivots. As a result of careful measurements of the wear of pivots and of both glass and synthetic sapphire bearings, it has been found that an oiled glass bearing is better than an unoiled sapphire bearing. Where sapphires are used, these also show better resistance to shock and vibration and possess a much longer life when they are used in the oiled condition. Such glass for bearings can be shaped in a comparatively simple manner before being given the final heat-treatment to produce the necessary hardness. See "Newly . . .," *Ceram. Abs.*, **21** [10] 211 (1942); "Synthetic. . .," *ibid.*, **22** [6] 105 (1943). V.R.E.

Hand glass plant meeting. J. F. GREENE. *Bull. Amer. Ceram. Soc.*, **22** [12] 419 (1943).

Hysil glass for gauges. ANON. *Glass*, **20** [8] 199, 207 (1943); *Engineering*, **156** [4051] 188 (1943).—Glass gauges used in the manufacture of small-arms ammunition are made of Hysil glass, a hard borosilicate. Hysil is 2 to $2^1/_2$ times as resistant to abrasion as soda-lime glass and slightly more resistant to impact. It has a coefficient of thermal expansion of 1.85×10^{-6} and can be cooled three times as rapidly as flint glass. See "Glass gauges. . .," this issue. B.C.R. & G.A.K.

Light reflections removed by new process. ANON. *Bull. Amer. Ceram. Soc.*, **22** [11] 389 (1943).

Problem of cords in glass. W. E. S. TURNER. *Jour. Soc. Glass Tech.*, **27** [120] 42–52T (1943).—The problem of cords is really one of homogeneity. Cords may be detected by several methods: (1) the naked eye, (2) the shadow method, (3) polarized light, (4) mechanical strength methods, (5) differences in refractive index, (6) density, (7) chemical durability, and (8) dyestuffs. Four physical properties are responsible for the relationship existing between cords and inhomogeneity: (*a*) mutual solubility of the silicates, (*b*) surface tension of the liquids, (*c*) viscosity, and (*d*) density. It is interesting to note that cords originate during the glassmelting processes from (1) incomplete melting, (2) incomplete diffusion, (3) corrosion of the refractory materials, (4) differential volatilization of one or more components of the glass, or (5) devitrification or devitrification followed by re-solution of crystals. The prevention and cure of cords is accomplished by a few direct efforts, such as (1) controlling the constancy of composition of raw materials and cullet and ultimate glass composition, (2) thorough mixing of the components, (3) the use of resistant tank blocks or pots, (4) proper design of tank furnace, (5) proper working out of glass after melting, (6) appropriate temperature distribution and constancy of temperature, (7) prevention of wash against the refractories by the rapid fall or rise in the glass level, (8) adequate insulation of feeder channels, and (9) remelting the cordy glass. See "Cords. . .," *Ceram. Abs.*, **22** [3] 50 (1943). R.H.B.

Spectrophotometric investigations on iron-containing soda-lime-silica glasses: II, Effect of arsenic and antimony oxides. T. H. WANG AND W. E. S. TURNER. *Jour. Soc. Glass Tech.*, **27** [120] 60–76T (1943).—Glasses of the parent composition 75 SiO_2, 10 CaO, and 15% Na_2O, containing varying amounts of iron oxide and of arsenic oxides, were melted at 1400° for 6 hr. in platinum in a gas-fired furnace after presintering of the mixture at 750°. The amount of iron oxide added varied from 0.05 to 0.25% when expressed as Fe_2O_3, and that of arsenic from 0.05 to about 3% expressed as As_2O_3. Subsequent chemical analysis of the glasses showed the arsenic to be present preponderantly as the pentavalent oxide, As_2O_5. From the spectrophotometric measurements, the effect of arsenic as a decolorizer appeared to be twofold: (1) its oxidizing effect shifted the ferrous-ferric equilibrium toward the ferric state, and (2) its presence caused some of the iron to form a colorless product. For arsenic oxide concentrations greater than 0.5%, the absorption curves indicated that all the iron was present in the ferric form; for concentrations lower than 0.5%, such as is the case in ordinary manufacturing practice, the major decolorizing effect was due to the oxidizing influence of the arsenic. The results of similar experiments using antimony oxide reproduced closely those due to arsenic oxide. For Part **I** see *Ceram. Abs.*, **22** [8] 136 (1943). R.H.B.

Suggested procedure for the examination after failure of glassmelting pots. ERIC PRESTON. *Jour. Soc. Glass Tech.*, **27** [120] 53–59T (1943).—This account of the examination after failure of open pots made of a sillimanite-ball clay mixture is given to encourage the wider adoption of photographic and petrological methods in the examination and recording of the performance and failure of glass-melting pots. P. discusses the performance of pots employed in the founding of a hard borosilicate glass at a temperature of 1470° to 1480°. Long pot life is not expected when melting this type of glass, but failure seemed to be due to shot-holing of the pot wall, pointing to local inhomogeneity possibly due to large iron spots, to inadequate pugging and mixing, or to slight differences in texture. A feature of the defective parts was the pronounced mullite development, which appeared to be caused by B_2O_3 vapor on alumina-silica refractories, for it was noted also on gathering hoods at 1350° and on the crown of an electric furnace melting a very high B_2O_3-content glass at 1250°. 14 photos. R.H.B.

Vacuum evaporated films on glass. S. BATESON. *Can. Chem. & Process Inds.*, **27** [8] 438–40 (1943).—

Theory, production, and applications are discussed. Strict control of the degreasing of the glass and of the degassing of the apparatus is necessary to obtain constant values for reflectivity. The transparent film should have a refractive index which approaches the square root of the index of the glass and should be sufficiently thick to show first order interference with white light. Lithium fluoride and calcium fluoride form soft films; cryolite lacks durability. Magnesium fluoride forms optically efficient films which are quite hard when specially treated. See "Glass without glare. . .," *Ceram. Abs.*, **21** [1] 8 (1942); "Principles. . .," this issue, p. 18. B.L.

Viscosity and working properties of glass: II, Rate of cooling and setting of colorless and colored glasses. JAMES BOOW AND W. E. S. TURNER. *Jour. Soc. Glass Tech.*, **27** [121] 94–112T (1943).—As a preliminary to studying the more complicated problem of ascertaining the changes in temperature and viscosity occurring at different points in a mass of glass undergoing conversion into glassware by hand or machine manipulation, a comprehensive study of the rate of cooling of glasses in a crucible was made. The glasses tested comprised five commercial types (colorless and colored) based on a soda-lime-silica composition, two colorless alkali-lead oxide glasses, a high softening point boroaluminosilicate, and a soda-silica glass. Their compositions and viscosities are given in Part I. In addition, eight glasses colored blue by cobalt oxide present in varying concentrations up to 5% were studied. Determinations were made, by Pt-Pt Rh thermocouples, of the temperatures at the glass surface and at intermediate points within the interior when the crucible and the glass within it were cooling under two different sets of conditions. From the temperatures recorded at different times of cooling, the corresponding viscosities were deduced. The differences between the temperatures of the surface and of the interior of a mass of glass during cooling depend on the time during which the cooling has proceeded, the initial temperature from which cooling begins, and the composition of the glass, particularly the presence of coloring constituents. In regard to the effect of time, the difference in temperature between the surface and the interior increases rapidly to a maximum during the early stages of cooling and then slowly decreases to zero as the glass cools uniformly to room temperature. In regard to the effect of the initial temperature from which cooling begins, the relative times required for the soda-lime-silica glass No. 9 to cool through the first 400° from the different initial temperatures were as follows: (*a*) for the surface, 1400° to 1000°, 1.0; 1300° to 900°, 1.43; and 1200° to 800°, 1.85; (*b*) for a point 0.8 in. below the surface, 1400° to 1000°, 1.0; 1300° to 900°, 1.29; 1200° to 800°, 1.60. These data apply to conditions in which the crucible and glass cooled slowly in an insulated chamber. Data are also given for other glasses and other temperature ranges and conditions. The differences in temperature between surface and interior were markedly greater in the colored than in the colorless glasses, because of the greater emissivity of the former and the selective absorption they exercise, resulting in the longer retention of heat in the interior during the cooling process. When cooling from an initial temperature of 1400°, the temperatures, after an interval of 2 min., were as follows for a colorless soda-lime-silica glass (No. 9), a carbon-sulfur amber glass (No. 16), a cobalt blue glass (No. 22), and an iron-manganese green glass (No. 20): (*a*) at the surface, 896°, 804°, 820°, and 753°, respectively; (*b*) at 0.8 in. below the surface, 996°, 1036°, 1045°, and 1063°, respectively. In colored glasses, the temperature differences between surface and interior are very marked within a narrow layer at the surface; whereas between the surface and 0.1 in. below it the difference was only 24° in the case of colorless glass No. 9, the differences for the same small depth for the colored glasses Nos. 16, 22, and 20 were 79°, 59°, and 102°, respectively. The rate of setting of a glass is influenced by the temperature coefficient of viscosity, the initial temperature from which cooling begins, and the composition, particularly the presence of coloring constituents. Tables and graphs show in detail the effect of these factors. The marked differences in temperature within the first 0.1 in. of the surface layer in the case of colored glasses give rise to correspondingly big viscosity differences resulting in a "skin" effect which governs subsequent manipulative operations. The effect of other factors is also referred to. For Part **I** see *Ceram. Abs.*, **22** [7] 116 (1943). R.H.B.

Willson Products, Inc., Reading, Pa. ANON. *Bull. Amer. Ceram. Soc.*, **22** [12] 391–95 (1943).

SEPARATE PUBLICATION

Vycor Brand Industrial Glassware for High Temperatures. *Corning Glass Works Bull.*, No. 838 (Oct., 1943).—Corning Glass Works announces the availability of industrial glassware made from its 96% silica glass No. 790. This glass, which may be generally compared with fused quartz in properties and performance, was developed several years ago. Since that time its application has been confined largely to laboratory glassware, and only recently has it been made available on a commercial scale in the form of industrial products. Section 1, "What you should know about 96% silica glass," covers composition, manufacture, chemical stability, physical properties, and maximum operating temperatures and includes a table of characteristics. Section 2, "What is available now in 96% silica glass," describes uses of and gives specifications for high-silica glass products such as containers, cylinders, tubing, flat glass, and rods. In Section 3, "What is important in designing Vycor glassware," the engineer will find useful design data. The booklet may be obtained without cost from the Industrial Division, Corning Glass Works, Corning, N. Y.

PATENTS

Apparatus for burning off glassware. W. L. MCNAMARA AND M. O. COMBS (Anchor Hocking Glass Corp.). U. S. 2,334,111, Nov. 9, 1943 (March 31, 1941).

Apparatus for making lens blanks. PERRY JOHNSTON (Pittsburgh Plate Glass Co.). U. S. 2,335,419, Nov. 30, 1943 (March 21, 1941).

Apparatus for and method of forming and treating glassware. W. K. BERTHOLD (Hartford-Empire Co.). U. S. 22,392, Nov. 16, 1943 (July 24, 1943); reissue of original U. S. 2,284,796, June 2, 1942 (Dec. 20, 1939).

Apparatus for use in the fabrication of multiply glass sheet glazing units. C. D. HAVEN AND J. J. HOPFIELD (Libbey-Owens-Ford Glass Co.). U. S. 2,334,624, Nov. 16, 1943 (Aug. 8, 1938; Nov. 9, 1940).

Apparatus for washing sheet glass. C. B. SCHAFER (Libbey-Owens-Ford Glass Co.). U. S. 2,334,651, Nov. 16, 1943 (Jan. 25, 1941).

Bifocal lens blank. G. A. CLEMENT. U. S. 2,333,362, Nov. 2, 1943 (April 1, 1942).

Coffee percolator. C. W. CLAPP AND P. L. ORR (Corning Glass Works). Can. 415,470, Sept. 28, 1943 (Dec. 2, 1941; in U. S. Dec. 26, 1940). G.M.H.

Core for glass molds. R. A. SENKBEIL (Maryland Glass Corp.). U. S. 2,334,653, Nov. 16, 1943 (Feb. 10, 1942).

Electric incandescent lamp. H. H. HELMBRIGHT (Canadian General Electric Co., Ltd.). Can. 414,238, Aug. 3, 1943 (Nov. 4, 1941). W. P. ZABEL (Canadian General Electric Co., Ltd.). Can. 414,240, Aug. 3, 1943 (Jan. 6, 1942). G.M.H.

Electric lamp. G. E. INMAN (Canadian General Electric Co., Ltd.). Can. 414,239, Aug. 3, 1943 (Jan. 6, 1942). G.M.H.

Electrical insulator. W. H. SAID (Corning Glass Works). Can. 415,177, Sept. 14, 1943 (March 25, 1942. G.M.H.

Fiber-forming apparatus. GAMES SLAYTER (Owens-Corning Fiberglas Corp.). U. S. 2,332,274, Oct. 19, 1943 (Feb. 1, 1941).

Fiber-glass-insulated electrical conductor. R. W. HALL AND H. A. SMITH (Canadian General Electric Co., Ltd.). Can. 414,868, Aug. 31, 1943 (Sept. 15, 1939). G.M.H.

Fibrous glass product. GAMES SLAYTER (Owens-Corning Fiberglas Corp.). U. S. 2,332,273, Oct. 19, 1943 (Aug. 4, 1938; Aug. 16, 1940).

Filter-making method and apparatus. J. H. PLUMMER (Fiberglas Canada, Ltd.). Can. 414,282, Aug. 3, 1943 (July 28, 1938). G.M.H.

Gaseous conduction lamp manufacture. A. F. HENNINGER AND G. D. HENNINGER. Can. 415,536, Oct. 5, 1943 (March 23, 1942). G.M.H.

Glass article perforating apparatus. R. A. HINKLEY (Corning Glass Works). Can. 415,176, Sept. 14, 1943 (May 13, 1941; in U. S. May 14, 1940). G.M.H.

Glass composition. R. A. SCHOENLAUB (Owens-Corning Fiberglas Corp.). U. S. 2,334,961, Nov. 23, 1943 (Dec. 5, 1940).—Glass in the form of fine fibers having substantially the following composition: CaO 16 to 19, MgO 3 to 6, Al_2O_3 12 to 16, SiO_2 52 to 56%, and B_2O_3 as an auxiliary flux in amounts of substantially 9 to 11%.

Glass compositions. HANS STEINBOCK (vested in the Alien Property Custodian). U. S. 2,335,463, Nov. 30, 1943 (July 12, 1939).—As a product of manufacture, fibrous glass, the glass whereof contains 55 to 60 silica, 10 to 15 boric acid, 20 to 30 earth alkalis consisting preponderantly of barium oxide, and 3 to 10% trivalent oxides selected from the group consisting of alumina, iron oxide, and manganese oxide.

Glass feeding. H. S. BRADY (Jeannette Glass Co.). U. S. 2,335,386, Nov. 30, 1943 (Aug. 26, 1941).

Glass-feeding apparatus. C. A. BROWN AND C. W. CRAIG (General Electric Co.). U. S. 2,334,064, Nov. 9, 1943 (May 1, 1940).

Glass filter. F. A. BICKFORD (Corning Glass Works). Can. 414,269, Aug. 3, 1943 (Dec. 26, 1940; in U. S. Jan. 2, 1940). G.M.H.

Glass furnace batch feeding apparatus. A. K. LYLE (Hartford-Empire Co.). Can. 415,190, Sept. 14, 1943 (April 18, 1941). G.M.H.

Glass furnace electrode arrangement. JOHN FERGUSON (Leonard H. Davis, administrator). Can. 415,111, Sept. 7, 1943 (May 18, 1942). G.M.H.

Glass grinding and polishing machine. PAUL MACA. U. S. 2,332,329, Oct. 19, 1943 (March 20, 1941).

Glassmelting furnace. LEVI SNYDER-LONGENECKER. Can. 414,529, Aug. 17, 1943 (June 24, 1941; in U. S. June 29, 1940). G.M.H.

Glass-toughening apparatus. JEAN-LOUIS SCHRADER (Soc. Anon. des Manufactures des Glaces & Produits Chimiques de St.-Gobain, Chauny & Cirey). Can. 414,-775, Aug. 24, 1943 (June 3, 1940). G.M.H.

Glassware foot. HENRY MODEL. U. S. 2,331,413, Oct. 12, 1943 (March 24, 1942).

Glassworking apparatus. ALBERT BÜNGER (General Electric Co.). U. S. 2,334,604, Nov. 16, 1943 (Nov. 12, 1940).

Glassworking machine. D. E. GRAY (Corning Glass Works). Can. 415,469, Sept. 28, 1943 (July 4, 1940; in U. S. Oct. 4, 1939). G.M.H.

Improving the durability of glass containers. UNITED GLASS BOTTLE MANUFACTURERS, LTD., AND E. SEDDON. Brit. 556,602, Oct. 27, 1943 (Jan. 25, 1943).

Inorganic fiber mat coherence increasing apparatus. GAMES SLAYTER (Fiberglas Canada, Ltd.). Can. 414,911 and 414,912, Aug. 31, 1943 (Dec. 2, 1940; in U. S. Dec. 24, 1936). G.M.H.

Lehr for glassware. D. G. MERRILL (Hartford-Empire Co.). U. S. 2,335,128, Nov. 23, 1943 (Nov. 5, 1941).

Lens edge grinding machine. A. G. CHAMPION. Can. 414,375, Aug. 10, 1943 (May 18, 1942). G.M.H.

Luminescent coating for electric lamps. E. T. CASELLINI (Sylvania Electric Products, Inc.). U. S. 2,331,306, Oct. 12, 1943 (June 18, 1941).—In an electric discharge lamp, a sealed glass envelope bearing on its interior surface a firmly adherent coating, the coating comprising a layer of luminescent particles only, and a porous layer-structure of a nonluminescent material, blanketing and binding together the particles of the luminescent layer, the nonluminescent material being of the group aluminum oxide, magnesium oxide, beryllium oxide, the contact of the binding structure being with surface particles only of the luminescent layer and with only a portion of the surface of each of the contacted particles, and the binding structure having portions extending between the surface particles to at least partially fill spaces between the surface particles.

Making glass articles. A. H. STEWART (Phoenix Glass Co.). U. S. 2,333,076, Oct. 26, 1943 (Nov. 8, 1941).—The method which comprises applying molten glass to a supporting surface, positioning a mold over the glass on the surface, decreasing the pressure in the mold, and increasing the pressure between the glass and the surface during the molding operation.

Making lenses. J. A. MOREHEAD (S. M. Dover). U. S. 2,332,246, Oct. 19, 1943 (May 31, 1939).

Making long pressed tubular glass structures. EUGENE SCHWARZ (Mantle Lamp Co. of America). U. S. 2,333,745, Nov. 9, 1943 (Feb. 13, 1939; Oct. 9, 1940).

Making porous filter bodies of particles of glass. J. A. JOBLING & Co., LTD., S. M. COX, AND R. J. GOSS. Brit. 556,678, Oct. 27, 1943 (Aug. 12, 1942).

Manufacture of fibrous glass. C. G. STAELIN (Owens-Corning Fiberglas Corp.). U. S. 2,335,135, Nov. 23, 1943 (April 29, 1940).

Manufacture of glass fibers. GEDEON VON PAZSICZKY (vested in the Alien Property Custodian). U. S. 2,331,946, Oct. 19, 1943 (Aug. 5, 1939).

Manufacturing multiple glazed units. E. J. BALLINTINE AND F. F. PAINTER (Pittsburgh Plate Glass Co.). U. S. 2,335,376, Nov. 30, 1943 (Feb. 27, 1941).

Method and apparatus for making glass structures by pressing and blowing operations. MANTLE LAMP CO. OF AMERICA. Brit. 556,582, Oct. 27, 1943 (Jan. 13, 1941).

Method and apparatus for producing glass fibers. GEDEON VON PAZSICZKY (vested in the Alien Property Custodian). U. S. 2,333,218, Nov. 2, 1943 (Nov. 6, 1939).

Method and apparatus for sealing glass envelopes. F. C. PERKINS (General Electric Co.). U. S. 2,334,123, Nov. 9, 1943 (March 13, 1942).

Method and apparatus for toughening sheets of glass. A. TILLYER AND B. I. G. SECURITIES, LTD. Brit. 556,558, Oct. 12, 1943 (April 7, 1942).

Mineral wool product. H. T. COSS, W. M. MACALPINE, AND H. V. SWINDELL (Johns-Manville Corp.). Can. 414,296, Aug. 3, 1943 (July 14, 1942). G.M.H.

Production of curled mineral fibers. GEDEON VON PAZSICZKY (vested in the Alien Property Custodian). U. S. 2,331,945, Oct. 19, 1943 (Feb. 3, 1939).

Production of fibers from minerals, etc. GEDEON VON PAZSICZKY AND HELLMUTH STEINGRAEBER (vested in the Alien Property Custodian). U. S. 2,331,944, Oct. 19, 1943 (Feb. 3, 1939).

Safety-type lighting fixture. H. J. CLASPY (Phoenix Glass Co.). U. S. 2,333,918, Nov. 9, 1943 (Nov. 26, 1941).

Silica-sand purification. F. W. ADAMS (Rockware Glass Syndicate, Ltd.). Can. 414,605, Aug. 17, 1943 (July 8, 1939; in Great Britain July 11, 1938). G.M.H.

Wax-impregnated glass fabric liner and gasket seal. E. E. LAUER (Merck & Co., Inc.). U. S. 2,333,535, Nov. 2, 1943 (June 2, 1939).

Structural Clay Products

A-B-C's of good salt glazing. ANON. *Brick & Clay Record*, **103** [3] 17–19 (1943).—Salt-glazing methods are reviewed with regard to the best glazing range, the proper silica content, methods for improving and maintaining gloss, the zinc process for producing green effects, and the secret of obtaining beautiful flash colors with coal tar. B.C.R.

Lincoln Tunnel. ANON. *Ohio State Univ. Eng. Expt. Sta. News*, **15** [4] 17–19 (1943).—Vitrified clay paving brick was selected for the Lincoln Tunnel rather than granite blocks, preferred for years in the New York City area because of their great wear resistance; 1,500,000 three-inch vertical-fiber lug blocks, made by an Ohio company, were used. Specifications called for an aver-

age modulus of rupture of 2000 and not over 18% loss in the standard rattler. W.D.F.

Manufacture of hollow brick. R. B. *Brit. Clayworker*, **50** [597] 101 (1942).—Fire-resisting hollow-brick floors were first constructed in the United Kingdom in 1901; they were also used by the Romans at Bath. They are produced by familiar methods and are fired at 950° to 1000°C. V.R.E.

Old Salem houses used brick interestingly. JOSEPH S. SICKLER. *Amer. Home*, **30** [5] 66–70 (Oct., 1943).—S. describes Early American brick houses found in and around Salem County, N. J., and in towns noted for these masterpieces of brick. Salem County boasts of houses built of old brick which was used as a definite part of the ornament. These houses built before 1750 have on their walls the dates, the initials of the builders, and ornamental work. Master bricklayers of the period 1720 to 1760, when most of this work was done, are discussed. The blue or glazed units which intermingle with the ordinary red brick give brilliance to the patterns; differing opinions regarding this glazing are discussed. A few of the houses are pictured. A.G.B.

Prefabricated brickwork. ANON. *Claycraft*, **16** [12] 487 (1943).—Two experimental houses being built use prefabricated sections of brickwork, of one brick thickness and weighing up to 15 cwt. The brick are laid on a specially prepared concrete casting floor, with molds for jointing between brick, and are then grouted over with cement slurry. G.A.K.

Producers' Council, Incorporated. FREDERICK HEATH, JR. *Bull. Amer. Ceram. Soc.*, **22** [11] 388–89 (1943).

Proper cooling of kilns helps control salt-glazed tile color. ANON. *Brick & Clay Record*, **102** [6] 18–19 (1943).—In the production of light-colored salt-glazed tile, uneven cooling of the kiln results in considerable color variation in the ware. Tile in the slower-cooling sections of the kiln develop a darker color than those in the faster-cooling portion. This can be prevented by blowing air through the flue tunnel. Production and inspection methods are described. B.C.R.

Proposed American Standard Basis for the Coordination of Dimensions of Building Materials and Equipment—A62.1. ANON. *Bull. Amer. Ceram. Soc.*, **22** [12] 417–18 (1943).

Resistance of brick walls to wind. H. A. SWEET. *Eng. News-Record*, **131** [17] 630–31 (1943).—After analyzing the stability of a fire wall 50 ft. high that failed because of a 32-m.p.h. wind, S. discusses the restriction on fire walls in city building codes and the inadequacies of these codes. Assuming that a wall should withstand a given maximum wind velocity, he studied the permissible ratio of height to thickness and the pressure at which brick walls will crack. The height of unbraced brick walls should not be more than ten times the thickness; walls of tile have similar height limitations. G.A.K.

Staffordshire blue brick and their uses: IV. ANON. *Brick Builder*, No. 53, pp. 40–42 (1939).—The use of blue brick for bridge building and sewer construction is discussed. For Parts II and III see *Ceram. Abs.*, **20** [1] 17 (1941). V.R.E.

Strength of undermined strata. W. H. EVANS. *Bull. Inst. Mining & Met.*, No. 439, pp. 1–26 (1941).—Brick beams bear a close resemblance to certain types of mine roofs. Experiments were made on voussoir beams using common building brick. Illustrated. V.R.E.

Structural tile manufacture in Germany is rigidly standardized. FRANK E. SONNENSCHEIN. *Brick & Clay Record*, **103** [1] 25 (1943).—By government decree, the number of types of hollow tile structural shapes has been reduced from at least 150 to 10–15. Size specifications are given. Most of the objectives thus resulting have been achieved in this country by voluntary adherence to A.S.T.M. standards and the mere application of common sense. B.C.R.

Uses of red engineering brick. ANON. *Brick Builder*, No. 55, pp. 33–37 (1939).—Engineering brick have a crushing strength of not less than 460 tons per sq. ft. and are available with a strength of over 800 tons per sq. ft. They are used for the heavy engineering work of railways and collieries and in sewers, tunnels, chimneys, waterworks, and bridges. V.R.E.

PATENTS

Building brick and reinforced brick structures. F. D. METHVEN. Brit. 556,278, Oct. 13, 1943 (March 24, 1942).

Building wall construction. L. E. WILLSON. U. S. 2,335,555, Nov. 30, 1943 (Sept. 5, 1939).—The method of constructing a tile-faced wall which includes first applying to a backing member a plurality of vertically spaced, horizontally extending, parallel metallic strips of readily pliable material, each several times as long as one of the tile.

Refractories

Action of magnesium and aluminum salts as binders for refractories. ANON. *Brick & Clay Record*, **103** [2] 43 (1943).—The addition of an aqueous magnesium chloride solution at 25° to 30° Bé. to MgO results in the formation of magnesium oxychloride, known as Sorel cement. $AlCl_3$ is believed to act differently, probably hydrolyzing to form an aluminum hydroxide gel which serves as the binder. Slightly soluble salts may be used as binders owing to their crystallization in the pores of the refractory material. See "Refractories life. . .", *Ceram. Abs.*, **22** [6] 102 (1943). B.C.R.

Basic open-hearth, modern plant and practice. J. A. DAVIES. *Jour. West Scot. Iron & Steel Inst.*, **50** [4] 39–43 (1942–1943); *Iron & Coal Trades Rev.*, **147** [3932] 45–47 (1943).—D. describes the laying up and preheating of a basic open-hearth furnace. Chrome magnesite is used for port blocks and back walls. The need is expressed for a basic refractory (of British origin and production) not susceptible to spalling or bursting through absorption of iron oxide. Stabilized dolomite brick will need improvement to compete with magnesite brick after the war. The all-basic furnace is preferred, especially because it permits a higher operating temperature and causes small formation of slag in pockets and less fettling owing to the absence of silica drip. Its disadvantages are the difficulties encountered when shutting down and the high cost of installation. High-alumina brick in checkers are superior to silica brick because of their greater resistance to slagging by basic dusts. B.C.R. & M.HA.

Basic open-hearth refractories and furnace maintenance. ANON. *Ind. Heating*, **10** [7] 1040–44; [8] 1175–76, 1180 (1943).—Topics discussed at the 26th Conference of the National Open-Hearth Steel Committee and the Blast Furnace and Raw Materials Committee of the American Institute of Mining and Metallurgical Engineers are presented. Open-hearth bottom maintenance, progress on basic roofs, furnace maintenance, and hot-topping steel were discussed. Basic roofs fail in the same manner as basic walls, i. e., iron oxide builds up in the exposed surface of the refractory (hot face) and spalling occurs. Parts smeared with chrome cement appear capable of lasting indefinitely. Silica brick in walls seem still to be equivalent to basic brick. Furnace maintenance depends mainly on operating practices and proper construction. An improved method of slag removal is described by which the slag is removed in a large block; removal time is reduced and damage to other parts is avoided. In hot-topping steel, the hot-top opening should be at least 70% of the ingot top opening, and the best ratio of hot-top height to width is probably 1:1, with a higher ratio for smaller sized molds. General practices of ingot handling were discussed. M.HA.

Burning dolomite for magnesium. T. C. TAYLER. *Pit & Quarry*, **34** [11] 46–48 (1942).—T. discusses the diffi-

culties encountered in the calcining of dolomite limestone to produce magnesium metal. Possible procedure is outlined, and 17 fundamental concepts are listed. Diagrams. M.R.

Determination of the workability factor for a plastic refractory. G. B. CUNNINGHAM AND J. F. KELLY. *Bull. Amer. Ceram. Soc.*, **22** [11] 366–69 (1943).—2 figures.

Development, design, and maintenance of acid and basic electric furnaces. ANON. *Ind. Heating*, **10** [11] 1636–42 (1943).—A summary of the proceedings at the first session of the conference of the Electric Furnace Steel Committee of the Iron and Steel Division, American Institute of Mining and Metallurgical Engineers, in Pittsburgh, Oct., 1943. Trends in development, design of electric melting furnaces, charging methods and preparation of charge, electrical features, and refractories used in the roofs are discussed. Acid roofs (silica brick) should not be used on a basic-lined furnace because iron oxide on the acid roof, reacting during the reducing period, decreases roof life appreciably. M.HA.

Dolomite as source of refractories. ANON. *Pit & Quarry*, **34** [8] 36 (1942).—Basic Refractories, Inc., is producing a basic refractory from dolomite (see "Improved . . .," *Ceram. Abs.*, **22** [8] 138 (1943)). The Standard Lime & Stone Co. produces a refractory from the product obtained by leaching the slightly soluble calcium oxide from dolomite with large quantities of water. Two other processes are now in the pilot-plant stage. M.R.

Electrically fused forsterite-olivine: I and II. U. S. BUREAU OF MINES, ELECTROTHERMAL SECTION OF THE ELECTROTECHNICAL LABORATORY. *Jour. Amer. Ceram. Soc.*, **26** [12] 405–13 (1943).—11 references, 11 figures.

Factors influencing the staining of silica brick. L. J. TROSTEL. *Jour. Amer. Ceram. Soc.*, **26** [11] 368–73 (1943).—10 references.

Factors insuring satisfactory industrial furnace refractory construction. JOHN WALLERIUS AND FRANK ERICSON. *Metal Progress*, **44** [4] 632–34 (1943).—W. lists 19 factors involved in furnace construction to insure maximum life, minimum maintenance, and economical operation. B.C.R.

How refractories are used in gigantic installation at Basic Magnesium, Inc. F. A. MCCANN. *Brick & Clay Record*, **103** [3] 51–54 (1943).—Three classifications may be made of the clay products used at the Basic Magnesium, Inc., plant at Las Vegas, Nev.: (1) those with the ability to withstand acids; (2) those withstanding acid, molten $MgCl_2$, high temperature, and spalling; and (3) regular high-heat and superduty refractories. Brick requiring acid resistance are ground to size. Various types of grinders used for this purpose and the construction of equipment using refractories are described. B.C.R.

Importance of refractories in wartime. C. E. BALES. *Ohio State Univ. Eng. Expt. Sta. News*, **15** [4] 3–4 (1943).—Refractories are essential in many war industries. They are much better in quality than those available in World War I. W.D.F.

Increasing capacity in water-gas sets with thin-walled generator lining. R. J. HORN. *Amer. Gas Assn. Monthly*, **24** [6] 216–17 (1942).—The desired increase in capacity of existing water-gas generators may be accomplished by increasing the inside diameter because this largely determines the capacity. The Central Hudson Gas & Electric Corp., Poughkeepsie, N. Y., has used thin silicon carbide linings for this purpose since 1938. The capacity of one generator was increased 40% over the manufacturer's rating. Thin linings appear to have a fairly long life expectancy. One generator with a $2^1/_2$-in. thick silicon carbide lining has operated 1740 hr. with an additional 2000 hr. of standby service. Diagrams are given of three total wall thicknesses, viz., $7^1/_4$, $8^1/_4$, and 10 in. M.R.

Influence of water vapor on silica brick at high temperatures. FRED A. HARVEY. *Jour. Amer. Ceram. Soc.*, **26** [11] 373–77 (1943).—7 references, 3 figures.

Magnesite in kiln linings. A. W. COMBER. *Cement & Lime Manuf.*, **13** [4] 63–66 (1940).—C. discusses methods of burning magnesia and states that the approximate melting point is 2500°C. Iron compounds have a significant effect on the properties of magnesia refractories as shown by a comparison of Styrian bruennerite containing 86.7% MgO and 6% Fe_2O_3 with Grecian amorphous magnesite containing 93.4% MgO and 0.5% Fe_2O_3. The falling loads per square inch are as follows:

°C.	Styrian (lb.)	Grecian (lb.)
15	2062	5974
1500	51	2631
1600	26	114

The best refractory magnesite is that made from the purest mineral heated to its fusion point in an electric furnace. The specific gravity of periclase is given as 3.583, whereas that of magnesioferrite ($MgO \cdot Fe_2O_3$) is 4.57 to 4.65. R.W.MCA.

Magnesite production highest in history. ANON. *Pit & Quarry*, **36** [3] 53 (1943).—The 1942 mine output of domestic crude magnesite reached an all-time high of 497,368 short tons. The increase in demand for dead-burned magnesia refractories in the steel industry was one of the reasons for the 33% gain in production. M.R.

Magnesite ramming material. ANON. *Brick & Clay Record*, **103** [3] 55–56 (1943).—Magnamix, an 80% magnesia material suitable for ramming in furnace bottoms has been developed by the Harbison-Walker Refractories Co. The method of installation is described in detail. B.C.R.

Maintenance of basic open-hearth furnace linings. A. JACKSON. *Ind. Heating*, **10** [11] 1710–14 (1943); *Engineering*, **156** [4055] 265 (1943).—Since 1939 efforts have been made to replace magnesite and chrome ore to the greatest possible extent. Laboratory trials on the use of serpentine showed that an 80/20 mixture of serpentine-magnesite best satisfied the requirements of refractoriness and economy of chrome ore and magnesite. Mixtures of chrome ore and serpentine were unsatisfactory. Because the new material did not prove so good as the material it replaced, the structural work of the furnace front was strengthened and openings were cut through the plate-work between each door to minimize shutdown time for repairs. See "Linings. . .," *Ceram. Abs.*, **22** [1] 11 (1943). M.HA. & G.A.K.

Manufacture of metallurgical and hard-fired brick from Donawitz blast-furnace slag. F. SCHWARZ. *Ziegelei Anz.*, **55**, 61–62 (1942); abstracted in *Stahl & Eisen*, **63** [11] 225 (1943).—The slag had the composition 35.3 SiO_2, 28.9 CaO, 16.5 MgO, 10 Al_2O_3, 1.6 FeO, 5.7 MnO, and 1.3% S. The brick were pressed from this material with an addition of 4% of finely ground lime and were hardened 8 hr. at 9 atm. They weigh about 3.8 to 4.2 kgm., are 25% porous, and have compressive strengths of 30 to 200 kgm. per cm.^{2}. The process requires 125 kgm. of Styrian anthracite for 1000 brick, while about 200 kgm. are required for brick from loam. The addition of 1.5% sulfite lye to the normal mixture increased the compressive strength, as did the addition of 2% calcium chloride. The production of a high-quality metallurgical brick and cement from the Alpine blast-furnace slag seems to be a buffer-chemical question in that during the formation of the cement, a definite alkaline pH value of 10.5 must not be exceeded. As stimulants for the hydraulic properties, soda and caustic magnesite are better than the usually employed Ca, Na, and K lyes. This behavior of the Alpine blast-furnace slag is due to its high content of magnesia and MnO. The definite pH value prevents the precipitation of magnesia as water-containing hydrate which disturbs setting. Ger. Pat. 715,250 describes the manufacture of hard-fired brick from the magnesia-rich Donawitz blast-furnace slag. Gladenhof clay with 18 to 20% Fe_2O_3 was dried, ground fine, and mixed with granulated or crystallized blast-furnace slag by adding 0.2 to 0.3% by weight of soda (referred to the clay part). The ratio of slag to clay is 80–85:20–15. The mixture is formed with an addition of 4 to 6% water. After drying one day, the brick are fired in a coal-fired furnace. The standard brick weigh, after firing at 1000°C., 3.5 kgm. and have a porosity

of 20% and an average compressive strength of 150 kgm. per cm.^{2}. M.Ha.

Mottled or colored silica brick. S. M. Phelps and R. W. Limes. *Jour. Amer. Ceram. Soc.*, **26** [11] 378–87 (1943).—14 references, 8 figures.

Mottled silica brick, facts, fancies, and fallacies. Fred A. Harvey and Clyde L. Thompson. *Jour. Amer. Ceram. Soc.*, **26** [11] 361–64 (1943).—14 references, 6 figures.

Plant investigation of variables affecting color of silica brick. J. Spotts McDowell. *Jour. Amer. Ceram. Soc.*, **26** [11] 364–67 (1943).

Production of aluminum. Anon. *Can. Mining Jour.*, **63** [4] 231 (1942).—Canada has no bauxite deposits, and many attempts have been made to produce aluminum from other rocks. There are several hundred patents on processes of extracting it from sources other than bauxite. Such processes are so costly as to be uneconomic. Aluminum production in the democratic countries has multiplied recently, but bauxite is abundantly available to Canada and the U. S. Other sources of aluminum have never been used when bauxite has been available. It occurs abundantly in many parts of the world, especially in Europe and in the tropical regions of South America, Asia, and Africa. There are important deposits in the U. S., including a limited supply of high-grade bauxite. In Germany, Japan, Norway, and Canada there is little or no bauxite, and these countries have made many attempts to use materials of lower grade as well as those in which the aluminum occurs as the silicate or sulfate. Germany has experimented with clays and phonolite and before the war built some small pilot plants to continue research on these materials. A few years ago a Japanese industry was founded on alunite. Later, high-alumina clays from North China and Manchuria were used; still later, Japan stopped using these materials in favor of bauxite from the Netherlands Indies. Russia has developed a fair supply of low-grade bauxite. The deposits are a tremendous distance from some of the plants. As a result of efforts to find more suitably located sources of aluminum, there has developed a limited use of nephelite. Italy has a modest supply of bauxite and has experimented with volcanic rocks containing leucite. Leucite, however, cannot compete with bauxite as a source of aluminum. In Norway, the use of labradorite has been discussed recently, and in Sweden andalusite has been considered. In Canada and the U. S., many experiments have been made on rocks other than bauxite. No serious attempts have been made to produce aluminum from these materials because the processes involved are complicated and expensive. None of them can produce alumina at a cost that will allow competition with alumina produced from bauxite. In Canada, many clays and shales contain 20% or more of alumina. Anorthosite and nepheline syenite are abundant. G.M.H.

Recovery of alumina from highly siliceous ores. D. D. Howat. *Mine & Quarry Eng.*, **8** [10] 219–24 (1943).—Among the few alternatives to the Bayer process for the production of purified alumina are furnace processes, the basis of which is to produce alumina in the soluble form as sodium aluminate while combining the lime and silica to form insoluble silicates. Recoveries of 74 to 88% alumina are possible with optimum ratios of CaO, Na_2O, SiO_2, and Al_2O_3. V.R.E.

Refractory materials in blast furnaces. G. R. Rigby and A. T. Green. *Jour. West Scot. Iron & Steel Inst.*, **50** [2] 17–26 (1942–1943); *Iron and Steel*, **16** [8] 291–96 (1943).—Blast-furnace refractories were studied by detailed examination of blown-out linings. Furnaces were found in which no lining remained in the bosh region, the bosh plates being coated by merely 3½ in. of scar. Linings have also built up in certain positions due to scar formation. Failure of the brickwork is attributed to the following causes: (1) CO disintegration: Decomposition of CO is catalyzed by metallic iron in the range 400° to 650°C. (2) Alkali vapors: Concentrates of a mushy material toward the back of the lining or cooler blocks in positions 30 to 40 ft. down the stack consist of as much as 30% alkali, mainly K_2O; the vapors also react with the brickwork to from kaliophilite ($K_2O \cdot Al_2O_3 \cdot 2SiO_2$) and leucite ($K_2O \cdot Al_2O_3 \cdot 4SiO_2$). (3) Limey slags, anorthite ($CaO \cdot Al_2O_3 \cdot 2SiO_2$) and gehlenite ($2CaO \cdot Al_2O_3 \cdot SiO_2$): These slags were produced in the reaction of blast-furnace slag on the firebrick. (4) Zinc-lead: Their presence is not considered harmful, although cases are known where zinc has caused expansion of the brickwork due to oxidation of the metallic zinc. The properties desired for refractories in the stack, bosh, and hearth are discussed. In correlating the life of a lining with the furnace output, low output and low blast pressure tend toward longer life, but considerable variation still occurs between furnaces of similar outputs. Segregation of the burden, especially when a considerable amount of fines is present, has an appreciable effect on the resultant temperature of the lining, the temperature reaching a maximum at the lining in some cases and in the middle in others. Removal of the fines might materially increase the life of the refractories. It is generally admitted that water-cooling of the bosh is desirable. There have been cases in which the coolers have extended into the furnace as much as 13 in., the brickwork around them having been eroded. Water-cooling of all portions of the furnace where the lining temperature exceeds 450°C. may be profitable. B.C.R. & E.H.McC.

Silica refractory brick tests. Anon. *Rock Products*, **46** [10] 47 (1943).—Yough brand silica brick installed in the arches of a vertical shaft kiln having a Dutch-oven type of furnace were still in good condition after 32 months' operation. This test kiln was operated by the Kelly Island Lime & Transport Co. B.C.R.

Silicon carbide linings in water-gas generators. T. F. Papen. *Amer. Gas Jour.*, **159** [4] 37–39 (1943).—P. describes the use of silicon carbide refractory linings for gas generators. When the generator was shut down for repairs, the lining was examined and only minor cracks were found in the brickwork. After 19,000 hours of service, the silicon carbide brick had to be replaced around the cleaning doors because the action of breaking up and removing clinkers had fractured the brick framing the doors. G.A.K.

Sillimanite-chrome mixtures. A. A. Chadeyron and W. J. Rees. *Bull. Brit. Refrac. Research Assn.*, No. 53 (Feb., 1940); reprinted in *Trans. Brit. Ceram. Soc.*, **42** [8] 163–70 (1943).—Fired sillimanite mixes containing up to 20% of chromic oxide and 5 and 10% of a South African chromite and an Indian chrome concentrate have been tested in the laboratory. The results of slag tests using (*a*) an acid open-hearth slag, (*b*) a basic open-hearth slag, and (*c*) a hammer scale indicated a marked increase in the resistance of ferruginous slags with contents of chromic oxide up to 15%. Mixtures of higher chromic oxide content did not show any further increase in slag resistance. The refractoriness under load was slightly lowered for mixtures containing up to 15% Cr_2O_3 and appreciably reduced for amounts in excess of this. An improvement in slag resistance was also found with the products containing chrome ore, but it was less than that obtained by the use of chromic oxide. The refractoriness under load was reduced. The spalling resistance of all the test products was high. The thermal expansion was slightly increased by additions of chromic oxide and chrome ore. R.A.H.

Slagging reactions—a correction. J. F. Hyslop. *Jour. West Scot. Iron & Steel Inst.*, **50** [1] 2 (1942–1943).—Two errors appearing in the original paper ("Refractories...," *Ceram. Abs.*, **20** [11] 264 (1941)) are corrected: (1) X-ray examination of alumina heat-treated on a chrome brick and of alumina which crystallized in reaction layers of aluminosilica refractories shows that the alumina is alpha and not beta as stated. (2) X-ray examination of a spinel brick which burst when attacked by iron scale and of a forsterite brick showed iron oxide in the upper zones. This iron oxide was stated to be magnetite, whereas it is ferric oxide. B.C.R.

Spalling of firebrick. Anon. *Nat. Bur. Standards, Tech. News Bull.*, No. 302, p. 45 (1942).—Some results are given of tests for the determination of resistance to

structural and thermal spalling of fire-clay brick by the A.S.T.M. panel method. When using pressures of 0.2, 0.4, and 0.6 in. of water during reheating of the brick for 24 hours at 1600°C., the spalling loss in most cases increased directly with the furnace pressure. R.A.H.

Testing cupola furnace linings. JOSEF M. ROBITSCHEK. *Brick & Clay Record*, **102** [4] 51–52, 54, 56; [5] 47–50 (1943).—In studying the cause of the rapid destruction of refractories in the melting zones of cupolas, a slag test was run using the following three types of brick: (1) a quartz-grog brick containing 80% silica; (2) a grog brick containing 58% silica; (3) a ramming mix containing 84% silica. Complete chemical analyses, P.C.E., porosity, bulk density, and water-absorption data are given. Results of the slag test indicated that no correlation exists between it and service conditions. Service tests with brick of higher alumina content (41 and 44%) indicated that refractoriness under load is the important factor in determining the life of a refractory and cupola service. A study of service conditions led to the following conclusions: (1) rapid failure of brick of high silica content may be due to thermal stresses in blocks of too large dimensions; (2) durability of lining is determined by its ability to withstand mechanical stress at high temperatures; (3) consumption of refractories per ton of iron is greater than the average for furnaces operating with a high-melting viscous slag; (4) consumption of refractory depends greatly on the duration of heat; (5) data do not prove any definite relation between consumption of refractories and furnace diameter, blast pressure, hourly output, or composition of charge; (6) lowest consumption of refractories per ton of iron results from use of silica brick or natural sandstone, but these cannot be used when operating at a fast cycle; (7) monolithic linings, properly installed, made from a high-silica body prove more economical than firebrick linings but are restricted to smaller type furnaces and require a careful drying and heating treatment; and (8) cooling of the melting-zone lining or the use of basic refractories could prove economical if several days' run could be obtained. B.C.R.

Vitreous silica in refractories. C. G. HARMAN AND A. E. BADGER. *Brick & Clay Record*, **103** [5] 51 (1943).—To determine whether the expansion of silica brick in firing due to the inversion of quartz could be prevented by the addition of a material that shrinks when fired, test specimens were made consisting of lime, ganister, and vitreous silica in varying proportions and were dried and fired at different temperatures. Expansion data showed that 90% vitreous silica was necessary to prevent expansion. This was considered uneconomical. These samples were also weaker and more porous than those containing a higher amount of ganister. B.C.R.

Water-gas and coke-oven operations (a symposium): (1) Silicon carbide solid linings. A. S. HALL. Presented at Joint Production and Chemical Conference of Technical Section of the American Gas Assn., New York, May, 1943; abstracted in *Gas*, **19** [6] 21–22 (1943); *Gas Age*, **91** [12] 24–26 (1943).—Silicon carbide linings last for 8000 to 10,000 hr. as compared to 1500 hr. for a clay lining for a water-gas generator. Experience has shown that silicon carbide linings largely eliminate clinker adherence and permit the generator to be operated 22 to 23 hr. daily. They are very resistant to the abrasion of increased amounts of ash of low-grade fuels, withstand much higher temperatures, will not become loaded with carbon, and are inert toward inferior fuels. With the poorer fuels now available there is shorter life, but the silicon carbide linings still outlast the clay lining in the same ratio. There are now over 50 plants using one or more generators. H. tabulates detailed specifications for 29 of these generators, chiefly from the north Atlantic states. **(2) Underfiring with refinery oil gas.** E. E. WITHAM AND J. H. LONG. *Gas*, **19** [6] 22–23 (1943). **(3) Gasoline enrichment of producer gas.** W. O. KEELING. *Ibid.*, p. 24. **(4) Two shell water-gas sets in Boston.** D. S. REYNOLDS. *Ibid.*, pp. 25–26. R.G.C. & W.D.F.

PATENTS

Bonded refractory material and method of making. V. M. GOLDSCHMIDT. Brit. 555,757, Sept. 22, 1943 (Oct. 6, 1939).

Bonded refractory and method of making. V. M. GOLDSCHMIDT (vested in the Alien Property Custodian). U. S. 2,335,407, Nov. 30, 1943 (Aug. 23, 1940).—That method of making refractories which comprises the steps of making a refractory batch comprising about 40 to 75% of granular refractory material of high magnesium orthosilicate content and not over about 60% of finely divided refractory material, the batch being substantially free from substances injurious to the refractoriness of magnesium orthosilicate, mixing the batch with an amount of water not substantially exceeding that just necessary to plasticize the batch, and forming a refractory article from the moist batch, thereby producing a refractory article characterized in the fired condition by an apparent porosity of about 10 to 22%, by having a temperature of failure of at least about 1500°C. under a load of 25 lb. per sq. in., and by being resistant to peeling during long use at high temperature.

Constructing basic linings for electric furnaces, etc. L. J. SWIFT. Brit. 556,048, Sept. 29, 1943 (April 8, 1942).

Corrected dolomite refractory. G. E. SEIL (E. J. Lavino & Co.). Can. 415,331, Sept. 21, 1943 (June 25, 1940). G.M.H.

Electrical insulating method. R. R. RIDGWAY AND A. H. BALLARD (Norton Co.). Can. 414,013, July 20, 1943 (Oct. 23, 1940; in U. S. Oct. 27, 1939).—The method of making an electrical heating unit insulating material comprises the steps of melting and crystallizing magnesia, providing a crystalline material containing not over 0.1% by weight of ferric oxide, 0.3 to 5% of silica, and 0.5 to 3% of calcium oxide, roasting this material in granular condition in an oxidizing atmosphere at a temperature between 1250° and 1400°C. for at least 24 hr. to insure that the iron compound present is substantially wholly ferric oxide, and cooling the material. G.M.H.

Electrical insulation by magnesia. R. R. RIDGWAY AND A. H. BALLARD (Norton Co.). Can. 414,015, July 20, 1943 (Oct. 23, 1940; in U. S. Oct. 27, 1939).—A refractory, heat-conductive, electrical resistance heating element embedding and electrically insulating material consists of a granular crystalline mass comprised mainly of magnesia associated with a lesser amount of spinel comprising magnesia and another spinel forming nonferrous refractory metal oxide capable of absorbing iron oxide. G.M.H.

Furnace linings. BIRMINGHAM ELECTRIC FURNACES, LTD., AND A. G. E. ROBIETTE. Brit. 555,654, Sept. 15, 1943 (April 18, 1942).

Insulating refractory. C. J. KINZIE AND EUGENE WAINER (Titanium Alloy Mfg. Co.). Can. 415,667, Oct. 5, 1943 (March 22, 1939; in U. S. April 26, 1938). G.M.H.

Magnesia processing and electrical resistance. R. R. RIDGWAY AND A. H. BALLARD (Norton Co.). Can. 414,014, July 20, 1943 (Oct. 23, 1940; in U. S. Oct. 27, 1939).—The method of making an electrical insulating material from crystalline magnesia contaminated with iron oxide comprises the steps of heating to a temperature above 1200°C., forming a product in which the iron content is present substantially wholly as an oxide absorbed within the magnesia crystals, and quickly cooling the mass, thereby substantially preventing the formation of a separate phase of iron oxide crystals external of the magnesia crystals. G.M.H.

Magnesia refractory. G. E. SEIL (E. J. Lavino & Co.). Can. 415,332, Sept. 21, 1943 (June 25, 1940). G.M.H.

Making zirconium oxide refractories. EUGENE WAINER (Titanium Alloy Mfg. Co.). U. S. 2,335,325, Nov. 30, 1943 (Jan. 19, 1942).—A method of forming zirconium oxide refractories of high resistance to thermal shock comprising forming a composition containing a major quantity of zirconium oxide with not more than 5% of refractory oxides other than zirconium oxide, molding the composition into shape, and firing the molded shape in a carbonaceous reducing atmosphere at a temperature above 1900°C.

Manufacture of hot tops. W. A. TURNER (McLain

Fire Brick Co.). U. S. 2,335,622, Nov. 30, 1943 (April 28, 1943).—The method of making hot tops comprising the steps of forming a unitary hot top by extrusion, scoring each of two opposing side walls of the hot top during the extrusion, and thereafter severing the hot top along the score lines.

Manufacture of high-density periclase. TEYNHAM WOODWARD (Westvaco Chlorine Products Corp.). U. S. 2,335,374, Nov. 30, 1943 (Jan. 31, 1941).—In methods of making high-density periclase wherein hydrated magnesia is precipitated from magnesian brines under conditions such that the precipitated magnesia is in the form of a granular spongy mass of aggregated particles exhibiting a relatively low apparent density in mass and the magnesia is fired at a relatively high temperature and for such time as to drive off combined H_2O and cause shrinkage of the magnesia, whereby to produce periclase, the improvement which comprises subjecting the precipitate, prior to firing it, to a milling action in a mill having an impact beating action, the milling being sufficient to increase the apparent density thereof so that the periclase produced has, for given firing conditions, relatively increased apparent density and relatively lowered porosity compared with the same magnesia fired without prior milling.

Reverberatory furnace. TONY CRNCICH. Can. 414,645, Aug. 24, 1943 (Aug. 24, 1940). TONY CRNCICH (M. H. Detrick Co.). Can. 414,706, Aug. 24, 1943 (Sept. 24, 1942). G.M.H.

Terra Cotta

Acidproof tank has no steel or rubber. ANON. *Ind. Finishing*, **19** [1] 64 (1942).—A wooden tank is covered inside and out with hard-fired brick laid in acidproof silicate cement. C.W.

Effect of bentonite on glaze take-up of mechanically dipped tile. C. ATKINS AND MARCUS FRANCIS. *Tech. Paper Brit. Pottery Research Assn.*, Aug., 1939; reprinted in *Trans. Brit. Ceram. Soc.*, **42** [8] 157–63 (1943).—The effect of bentonite on the take-up of glaze by white wall tile was investigated. The difference in the weights of glaze taken up by hard-fired and easy-fired tile is considerably reduced by the addition of bentonite to the glaze. Treatment of a glaze with $4^1/_2$ to 5% of white bentonite considerably reduces the effects of differences in porosity of biscuit tile due to differences in firing. Bentonite is somewhat cheaper than glaze, and a thinner coat of bentonite glaze is required. More economies may be effected by eliminating the sorting of biscuit tile into sizes. The crazing resistance was improved in some cases by treating the glaze with bentonite, probably owing to the increased uniformity in thickness over a tile. R.A.H.

Engineering designs of a ceramic stove. DEWITT H. WYATT AND G. A. BOLE. *Ohio State Univ. Eng. Expt. Sta. News*, **15** [4] 9–12 (1943).—Satisfactory operation requires a concentration of high-temperature combustion to burn the gases and a magazine to get continuous coking. A ceramic grate and fire bowl are necessary to withstand the heat. The outside of the stove is round, with convector channels just inside to give the best transfer of heat to the room air. A space heater is required to (1) deliver 30,000 to 40,000 B. t. u. per hr., (2) have few or no metal parts, (3) be as small as consistent with good engineering design, (4) cost from $50 to $100 to build, (5) be a shipable unit, and (6) have eye appeal. Not all of these requirements have been fully met. Updraft fire tubes are necessary, as downdraft tubes give a lot of soot. The stove weighs 600 lb., but it may be possible to lighten it. See "Market. . .," *Ceram. Abs.*, **22** [11] 195 (1943). W.D.F.

Fireplace as a heating device. E. A. HITCHCOCK. *Ohio State Univ. Eng. Expt. Sta. News*, **15** [4] 12–16 (1943).—The fireplace was standard size. Tests were made of different grate areas, different backs, gas and coke fuels, etc. Nine tests were run. Room temperature was read on each of 12 standard thermometers in front of the fireplace, which could be moved vertically as a unit to three different positions; 36 temperatures were therefore read for each test. The results were as follows: (1) A stainless steel radiating fireplace back was less effective than rough cellular clay by 3° to 7°F. (2) Analyses of the gaseous combustion products indicate a rapid infiltration of air. (3) Low temperatures of exit gases indicate low heating efficiency but good ventilating efficiency. (4) The cellular-clay back radiated more heat with a larger grate area, but the ordinary back did not. (5) With the cellular-clay back, coke gave 14° to 27°F. higher temperature than with the ordinary back. (6) The cellular-clay back showed slightly higher temperatures along a line normal to it than on a horizontal line. (7) Radiation heating is important close to the fireplace but falls off rapidly; convection heating is appreciable much farther from the fireplace. W.D.F.

Ohio industrial biographies: 8, The Mosaic Tile Co. ANON. *Ohio State Univ. Eng. Expt. Sta. News*, **15** [4] 4–5 (1943).—The Mosaic Tile Co. was incorporated in Zanesville, Ohio, in 1894. It started with one round kiln but soon added more; in 1924 six tunnel kilns were built. Ceramic, vitreous, and semivitreous floor tile are made in ten sizes and six colors. It is one of the two largest tile manufacturers in the U. S. W.D.F.

Whiteware

Ancient encaustic tile. E. A. HUMPHREY FENN. *Cement, Lime & Gravel*, **17** [8] 251–52 (1943).—The types of flooring used in Roman houses, such as composition, mosaic, brick, tile, and tessellated pavements, are described with examples from Rome and from England. V.R.E.

Duplication of chrome-brown electrical porcelain glazes with nonessential materials. RICHARD B. FULLER AND ARTHUR S. WATTS. *Jour. Amer. Ceram. Soc.*, **26** [12] 414 (1943).

Lapp-type insulators. R. C. ANDERSON. *Elec. Times*, **102** [2647] 80–84 (1942).—The Lapp insulator is a single piece of porcelain with its associated metalwork. In its manufacture, air is removed from the clay by vacuum, and the clay is neutralized or normalized to eliminate variables. V.R.E.

Low-loss ceramics. G. H. GILLAM. *Elec. Times*, **103** [2690] 544–47 (1943).—Two large groups of low-loss ceramics are distinguished: (1) The titania group is characterized by relatively high specific inductive capacities and low dielectric loss and is therefore suited for high- and low-frequency work. (2) The nontitania group, with magnesium hydrosilicates as a base together with clay and a flux, is characterized by low power factors and low specific inductive capacities and is suitable for the insulation of high-frequency conductors. Dry-pressing methods give higher dimensional accuracy than damp-pressing, but the latter permits more complicated shapes. Extrusion, plastic pressing, hand turning, and casting are less used. Twenty per cent linear shrinkage may occur during firing, and the tolerance generally allowable may be ±2% on 0.4 in. and ±0.008 in. below 0.4 in. G. also gives practical pointers concerning dies, holes, walls, angles, draw, flatness, glaze, inserts, coatings, and precision. V.R.E.

New steatite electrical insulator factory. ANON. *Clay Products News*, **16** [10] 4–5 (1943).—A description is given of the first Canadian steatite plant at Georgetown, Ont. The plant is approximately 120 x 240 ft. with basement, and the ware is fired in a semimuffle, oil-fired, tunnel kiln. The kiln is 65 ft. long and holds 12 cars. The normal

firing cycle is 16 hr., but a cycle of 10 hr. can be used successfully. The accuracy of the heat distribution can be kept within 1/4 cone. G.A.K.

Possible use of ferruginous talcs in steatite dielectrics. LAURENCE E. KANE AND HERBERT G. UELTZ. *Jour. Amer. Ceram. Soc.*, **26** [11] 389–92 (1943).—3 figures.

Ring-horns for insulators. ANON. *Elec. Times*, **103** [2686] 432–33 (1943).—Tests made on various types of arcing rings for the protection of porcelain insulators show that lyre-shaped tubes with ring-horns at top and bottom are the most effective. V.R.E.

Study of bodies in the clinoenstatite field of the MgO–Al_2O_3–SiO_2 system. JOHN O. SEMMELMAN AND A. S. WATTS. *Bull. Amer. Ceram. Soc.*, **22** [11] 371–72 (1943).

Study of the talc minerals in steatite bodies. JOHN W. LENNON AND ARTHUR S. WATTS. *Bull. Amer. Ceram. Soc.*, **22** [11] 369–71 (1943).

PATENTS

Applying clay to jiggering molds. W. J. MILLER. U. S. 2,334,640, Nov. 16, 1943 (July 20, 1935; March 18, 1940).

Ceramic denture material and denture or denture part. R. W. ERDLE (Dental Research Corp.). U. S. 2,334,319, Nov. 16, 1943 (June 10, 1939).—As a new article of manufacture, a porcelain denture part formed of a fused porcelain comprising isotropic nepheline syenite.

Ceramic material. M. D. RIGTERINK (Bell Telephone Laboratories, Inc.). U. S. 2,332,343, Oct. 19, 1943 (Jan. 31, 1941).—The method of forming a ceramic material formed of small crystals constituting the major proportion of the structure of the material and of glass constituting a substantial proportion of the structure of the material cementing together the crystals in the material comprising intimately mixing finely divided talc, clay, and at least one alkaline-earth oxide other than magnesium oxide in proportions such that the sum of the constituents of the materials, calculated as oxides, fall within the parallelogram-shaped area on an SiO_2–R'_2O_3–RO mol % triaxial diagram approximately bounded by the parallel lines indicating 2 and 8 mol % of R'_2O_3 and by the parallel lines indicating 40 and 52 mol % of SiO_2, in which diagram R'_2O_3 represents essentially aluminum oxide and RO represents at least 25 mol % of magnesium oxide and at least 2 mol % of the alkaline-earth oxide, and firing the mixture of the materials to a temperature and thereafter cooling the fired ceramic material at a rate such that a substantial proportion of glass is formed.

Chemical closets. AUSTRAL SANITARY PRODUCTS, LTD., AND L. V. A. SMITH. Brit. 556,393, Oct. 13, 1943 (Dec. 23, 1941).

Chinaware stamping machine. G. E. LAWRENCE (T. M. Barclay). U. S. 2,335,213, Nov. 23, 1943 (Jan. 31, 1942).

Clay spreader. F. M. KINNARD. U. S. 2,335,123, Nov. 23, 1943 (Aug. 30, 1941).

Coating of insulators. E. H. FISCHER (Westinghouse Electric & Mfg. Co.). U. S. 2,333,557, Nov. 2, 1943 (July 31, 1940).—A device for coating the inner surface of a ceramic article.

Making apertures in plastic earthenware. R. H. ZINKIL (Crane Co.). U. S. 2,334,855, Nov. 23, 1943 (Nov. 8, 1940).

Spark plug. BERNARD HOPPS (Lodge Plugs, Ltd.). Can. 415,491, Sept. 28, 1943 (Aug. 25, 1942; in Great Britain Feb. 26, 1942). G.M.H.

Spark plug. H. K. KING. U. S. 2,334,203, Nov. 16, 1943 (Nov. 27, 1941). U. S. 2,334,204, Nov. 16, 1943 (Feb. 6, 1942). LODGE PLUGS, LTD., B. HOPPS, AND C. J. SMITHELLS. Brit. 556,330, Oct. 13, 1943 (March 28, 1942).

Spark-plug insulator. KARL SCHWARTZWALDER (General Motors Corp.). U. S. 2,332,014, Oct. 19, 1943 (Oct. 14, 1938).—A spark-plug insulator made by sintering into a dense, nonporous body a ceramic mixture consisting of 2 to 10 zircon, 2 to 98 kyanite, and not over 95% alumina, the insulator being fired at a sufficiently high temperature to disassociate the zircon so that the end product is free from zircon and consists of mullite and zirconium silicate glass, with any free alumina in the form of corundum.

Spark plug and method of making. TULLIO TOGNOLA (Bendix Aviation Corp.). U. S. 2,333,749, Nov. 9, 1943 (Jan. 31, 1941).

Equipment and Apparatus

Applications of the electron microscope in colloid chemistry. L. MARTON. *Jour. Phys. Chem.*, **46**, 1023–32 (1942).—A review is given of the development and uses of the electron microscope. R.A.G.

Compound grinding mill. ANON. *Cement & Lime Manuf.*, **15** [5] 57–64 (1942).—The mill and the fineness gradation which should be obtained are described. R.W.McA.

Contaminated thermocouples. F. KUNK. *Metal Progress*, **43** [5] 748 (1943).—Leaky protection tubes can result in severe damage to Chromel-Alumel couples in 4 hr. in an atmosphere containing ammonia additions. The couple was found to be brittle and slightly magnetic. Tubes prone to crack are made of the 18–8 or other high chromium-nickel steels. Pure nickel tubes have given excellent results in such an atmosphere. Welded tubes should be tested under air pressure to insure against leaks. B.C.R.

Controlled drilling and blasting in clay mines. CLYDE AUGSBURGER. *Bull. Amer. Ceram. Soc.*, **22** [12] 396–99 (1943).—4 figures.

Dielecometer. J. H. JUPE. *Elec. Rev.*, **133** [3431] 271–73 (1943).—A description is given of a versatile instrument for dielectric-constant determination, and some of its applications are discussed. The dielecometer was developed by H. S. Simons, who had earlier collaborated with L. Ebert. The dielecometer is of great value in determining moisture content of grains, powders, and manufactured goods such as cigarettes. Diagrams. M.R.

Du Mont Cyclograph for checking and sorting metals and alloys. ANON. *Machinery* [N. Y.], **50** [3] 212 (1943).—An ingenious electronic instrument that checks-evaluates, and automatically sorts metals and alloys according to their individual characteristics has been developed by the Allen B. Du Mont Laboratories, Inc., Passaic, N. J. When used as an electronic analyzer, the Cyclograph, by the use of tests at several frequencies (either one after the other or simultaneously), will grade pieces of metallic material according to case depth, depth of decarburization, amount of cold-working, brittleness (stress gradients), hardness gradients, and structure without injury to the work. Used as an automatic sorter consisting of modulated oscillator and relay, the Cyclograph sorts metal parts according to one of the following characteristics if all other variables are reasonably constant: analysis, heat-treatment, structure, size, wall thickness of tubing, thickness of plating or cladding, and magnetic or nonmagnetic property. R.H.B.

Electronic temperature control for furnaces. ANON. *Machinery* [N. Y.], **50** [1] 196 (1943).—Because electric resistance furnace temperatures are likely to vary, the Westinghouse Electric & Mfg. Co., Pittsburgh, Pa., has developed the Furnatron control system to keep such variations at a minimum. R.H.B.

Flotation kinetics: I, Methods for steady state study of flotation problems. R. SCHUHMANN, JR. *Jour. Phys. Chem.*, **46**, 891–902 (1942). **II, Effect of size on the behavior of galena particles.** A. M. GAUDIN, R. SCHUHMANN, JR., AND A. W. SCHLECHTEN. *Ibid.*, pp. 902–10.—The method is described and its application to galena particles is discussed. R.A.G.

Guard for glass electrodes. ANON. *Chem. Industries*,

53 [3] 376 (1943).—A guard is described and illustrated for the protection of electrodes during pH determinations. E.D.M.

High-vacuum technique. G. BURROWS. *Jour. Sci. Instruments*, **20** [2] 21–28 (1943).—B. considers various features of high-vacuum technique from the practical point of view under the following headings: (1) principles, (2) pumps, (3) backing pumps, (4) vacuum pipe lines, (5) detachable joints and jointing media, (6) vacuum gauges and indicators, (7) avoidance and detection of leaks, and (8) surface treatment. G.A.K.

Machinery for gravel and sand pits. J. THAME. *Cement, Lime & Gravel*, **15** [4] 61–63; [5] 82–85 (1941).—A description is given of excavating, transporting, grading, and loading equipment. Illustrated. V.R.E.

Precision hygrometry with a wet bulb. W. L. BALLS. *Nature*, **152** [3857] 389–90 (1943).—A method is given whereby the relative humidity of air can be determined to $^1/_2$ of 1%. An aspirator is required if recirculation of the air is needed. The wet- and dry-bulb thermometers are mounted in two parallel glass tubes sealed at the bottom and stoppered at the top with side tube inlet and exit and connection between them. The rate of flow at which the air impinges on the foot of the wet bulb is standardized. The stability of the system over long periods of time and its low standard error are its outstanding advantages. G.A.K.

Principles of the use of nonreflecting films in optical instruments. K. M. GREENLAND. *Nature*, **152** [3854] 290–92 (1943).—G. attempts to show that the optical principles of nonreflecting films permit them to be used under everyday conditions. The property of light on which they depend is that of interference, which is brought about by coating the glass surface with a thin transparent film that must be of a lower refractive index than the glass. A composite reflected ray will have zero intensity when the components from rays A and B are in opposite phase and equal in amplitude and the optical path difference is an odd number of half wave lengths. The optical thickness of film for zero reflectivity is given as $\mu t = (2n + 1)\frac{\lambda}{4} \times \frac{1}{\cos r}$, where μ = refractive index, t = thickness, and r = angle of refraction at the air-film boundary. By adjusting the thickness of an "ideal film," extinction of reflection could be obtained for any chosen angle of incidence up to about 45°. The refractive index of the film should be the square root of that of the glass. A silica film has the advantage of being of the same substance as the glass itself. The film is made by dissolving away the other constituents of the glass, leaving a silica skeleton. Fluoride films are deposited by the high-vacuum volatilization process, which generally gives a film of greater optical efficiency than does the chemical method. See "Vacuum. . .," this issue, p. 9. G.A.K.

Radiant heating for industrial processes. L. W. ANDREW AND E. A. C. CHAMBERLAIN. *Engineering*, **156** [4054] 245–46; [4056] 298–300 (1943).—Radiant heating is discussed under the following headings: (1) drying processes, (2) convection heating versus radiant heating, (3) drying paint on surfaces shielded from direct radiation, (4) practical sources of infrared rays, and (5) gas-operated infrared units. G.A.K.

Radiant heating invades industry. CARL P. MANN. *Ind. Heating*, **10** [9] 1338–42; [10] 1564–70; [11] 1696–1706 (1943); *Chem. Industries*, **53** [3] 332–35 (1943).—Radiant energy is being produced both by the infrared lamp and the radiant gas burner in which a gas flame is directed along a ceramic surface which becomes incandescent and converts more of the heat of combustion of the gas into radiant energy. The design of a radiant burner includes also the formulation and manufacture of special ceramic materials and their shaping and forming. Radiant energy is directional, which presents difficulties in designing ovens; but it has the advantage, however, of giving "spot" heating, a result that cannot be readily obtained by convection heating. The heat-absorption factor varies with the color of the material, black absorbing the most and white the least. Twenty per cent more time is required to cure a finish on a highly polished surface than on an unpolished one. The distance between the heat source and the work is of great importance. With either type of heating, the workpiece itself must be heated before a finish-curing process can be completed. The shorter the curing time of a piece, the greater is the cure-retarding effect of increasing the weight of a piece. Considering the rate of production per unit of floor space, the convection oven will have the highest capacity, and the infrared lamp the lowest. If the products of combustion of the radiant gas burners can be allowed to combine with their radiant-heat output, the production rate of this combination will be highest of all. In infrared-lamp installations, baking temperatures in excess of 600 °F. are not practical and therefore not applicable to vitreous enamel and high-temperature reacting baking. The infrared lamp is cheapest, the radiant gas burner next, and the convection oven most expensive. Plaster molds used in the fine chinaware industry, which formerly required 24 hr. for drying, can now be dried in 1 hr. Radiant gas burners have been found particularly effective in setting the coating on the inside of fluorescent lamps. The radiant heat is transmitted through the transparent glass of the tube to bake the coating on the inside. The temperature of the oven is 1400 °F., which is within 10 °F. of the glass softening temperature. The steel, ceramic, and china industries are making advances both in economy of operations and quality of product by the use of increased furnace and kiln temperatures, uniform distribution, and accuracy of control. See *Ceram. Abs.*, **22** [11] 197 (1943). M.HA. & E.D.M.

Simple method for making graduated gray wedges for spectrum analysis in the ultraviolet. N. S. SWENTIZKI. *Zavodskaya Lab.*, **8** [4–5] 512–14 (1939); abstracted in *Physik. Ber.*, **23** [11] 1169 (1942).—A quartz plate is coated with soot by drawing it with increasing velocity through a benzine or petroleum flame. This produces layers of decreasing thickness, the wedge effect of which can be determined by the variation of the velocity. The absorption in the wedge was found to be dependent on the wave length and to be linear in the range 250 to 340 mμ. M.HA.

Simple temperature control for laboratory electric furnaces. W. HIRST AND C. G. CANNON. *Jour. Sci. Instruments*, **20** [8] 129–32 (1943).—A description is given of an automatic furnace control, using a potentiometer bridge and a commercial photocell relay unit, which keeps the furnace temperature to within ±1 °C., when a Chromel-Alumel thermocouple is used, and in addition controls the run-up to final temperature at any given uniform rate of heating within the limits of performance of the furnace winding. The apparatus can be constructed from standard components. A circuit is described by means of which several furnaces can be used simultaneously, controlled by the same photocell unit. G.A.K.

Thermostatically controlled glass electrode apparatus for pH measurements. L. F. LE BROCQ. *Chem. & Ind.*, **62** [37] 350 (1943).—B. describes a thermostatically controlled glass electrode/calomel electrode system for pH measurements which has been in use for a number of years at the Royal Aircraft Establishment, Farnborough. R.H.B.

Unavoidable losses in air compression. P. W. PEEL. *Glass*, **20** [9] 230, 239 (1943).—In determining the volumetric efficiency of an air compressor, efficiencies calculated from indicator cards may be appreciably higher than those calculated from the actual output of air which has been carefully measured. The use of meters is considered undesirable due to the difficulty of calibrating them and the possible error resulting from the pulsations of the compressor. A method of measuring the volumetric efficiency by use of a low-pressure nozzle is described. Calculations are based on the formula:

$$Q = 3.64KD^2\sqrt{\frac{HT}{Pm}}$$

Q = cu. ft. of air flowing per min. at observed temp. of up-

stream side of nozzle and absolute pressure of downstream side (usually atmospheric).
D^2 = diam. of smallest part of nozzle throat (in.).
H = observed water column (in.).
T = absolute temp. of air entering nozzle which is observed temp. °F. + 460.
Pm = absolute mean pressure (lb./in.^{2}) between entering and leaving sides of nozzle.
K = coefficient of nozzle depending on shape; with well-rounded edges it is 0.98–0.99.

A sample calculation is shown. B.C.R.

Use of the microprojector in the mechanical analysis of small samples of river sand. RICHARD G. GRASSY. *Jour. Sediment. Petrol.*, **13** [2] 47–57 (1943).—A method is described by which the size distribution of very small samples may be determined. The resulting data compare with those obtained by sieve analysis. The method can be used when the sample is too small for sieving. G.M.H.

Variable-speed control. ANON. *Elec. Rev.*, **133** [3433] 337–38 (1943).—The use of a magnetic coupling for power generation is discussed. Engines being tested may be loaded to any value, and the power developed is transmitted to an alternator. Energy due to speed differences is absorbed by coupling slip. The advantage of a magnetic coupling with electronic control circuit over a conventional clutch for this purpose is that increased slip gives greater torque at all engine speeds. Infinitely variable speed regulation by magnetic or electric clutches with electronic control is suggested as offering possibilities in securing the most suitable vacuum for turboalternators. M.R.

SEPARATE PUBLICATION

Radiant Heat Drying Lamps. *Westinghouse Lamp Div. Booklet*, A-3817, 12 pp. (1943); reviewed in *Chem. Industries*, **53** [3] 384 (1943).—The design of radiant-heat installations, arrangement of equipment, and electrical circuit design are discussed. Specific data are given for three general applications, viz., evaporation of water or other solvents, paint drying, and increasing temperatures of materials to facilitate manufacturing processes. Formulas are stated for determining the wattage required in each case. Illustrated. E.D.M.

PATENTS

Electrolyte for the polishing of metal surfaces and method of use. C. L. FAUST (Battelle Memorial Institute). U. S. 2,334,699, Nov. 23, 1943 (Nov. 23, 1938).—An electrolytic solution for use in the anodic polishing of metals selected from the group consisting of iron and its alloys, nickel and its alloys, and German silver, consisting essentially of 5 to 85% of sulfuric acid and 5 to 85% of orthophosphoric acid, the combined acid content being at least 50% but not over 90% by weight of the solution and the remainder being mainly water.

Excess dust-removing apparatus. ERIC LUNDGREN (E. B. & A. C. Whiting Co.). Can. 414,350, Aug. 3, 1943 (Oct. 10, 1940). G.M.H.

Hardness tester. D. F. SKLAR (Wilson Mechanical Instrument Co., Inc.). U. S. 2,333,747, Nov. 9, 1943 (July 18, 1941).

Piezoelectric crystal apparatus. W. P. MASON (Western Electric Co., Inc.). Can. 414,756, Aug. 24, 1943 (May 2, 1941). A. W. ZIEGLER (Western Electric Co., Inc.). Can. 414,757, Aug. 24, 1943 (May 2, 1941). G.M.H.

Piezoelectric crystal element. C. F. BALDWIN AND S. A. BOKOVOY (Radio Corp. of America). Can. 414,305, Aug. 3, 1943 (Oct. 5, 1937). G.M.H.

Piezoelectric quartz element. S. A. BOKOVOY (Radio Corp. of America). Can. 414,306, Aug. 3, 1943 (May 6, 1941). G.M.H.

Pulverulent material feeding apparatus. ERIC LUNDGREN (E. B. & A. C. Whiting Co.). Can. 414,349, Aug. 3, 1943 (Sept. 28, 1940). G.M.H.

Separation of solid materials of different specific gravities. FREDRICK TROSTLER (Sink and Float Corp.). U. S. 2,333,347, Nov. 2, 1943 (Oct. 9, 1940).

Volume meter for granular materials. J. C. GROSHORN AND W. E. GROSS (Secretary of War of the United States of America). U. S. 2,332,512, Oct. 26, 1943 (March 14, 1940).

Kilns, Furnaces, Fuels, and Combustion

America's war industry turns to gas to surpass production peaks. F. H. ADAMS. *Amer. Gas Assn. Monthly*, **24** [4] 133–37 (1942).—The use of gas for industrial heating and heat-treating has been increasing for some time. The ten-year period 1929–1939 saw a 39.2% increase. In 1941 alone, increase in industrial use amounted to 18%. At the same time, there was a 400% increase in demand for industrial and heat-treating furnaces. Under such conditions, the gas industry cannot evolve new processes or launch a comprehensive research program. Research and development, however, have been continuous since World War I when the use of gas as an industrial fuel was just being pioneered. M.R.

Automatic kiln control with thermocouple as primary element. O. J. PARRETT. *Instruments*, **16** [1] 4 (1943).—In equipping a tunnel kiln with an automatic draft control, a thermocouple was placed in the opening below the drop arch, where variations in temperature of 200°C. occurred. As the temperature at the drop arch falls, the controller closes the damper in the exhaust pipe enough to compensate for the additional vent created by the loading of lower ware. This installation resulted in lower gas consumption and maintenance of better firing conditions. B.C.R.

***Calculation of temperature distribution in time and space in a convection furnace by means of the Laplace transformation.** H. SCHUNCK. *Aluminium*, **25** [2] 82–89 (1943).—The theory and derivation of practical formulas are given together with a numerical example. M.HA.

Combustion principles should be applied when firing downdraft kilns: III. H. L. LONGENECKER. *Brick & Clay Record*, **102** [6] 20, 22–23 (1943).—Most of the firing in downdraft kilns is inefficient as to firing time and consumption of fuel. Most of the time lost is in the water-smoking period, due to the fear of the burner that he will raise the fires too fast. With good draft, there is little reason with most clays why the fires cannot be pushed. Excess air not only cools the top by absorbing heat and prevents overfiring but also carries the heat to the lower courses. Factors necessary in establishing a scheduled firing are (1) a knowledge of the vitrification range of the clay; (2) a good pyrometer installation; (3) sufficient draft, either induced or stack, to give control; (4) a record of each kiln covering percentage of grade A ware produced, length of firing time, highest heat indicated, cones used, coal consumption, and type of coal; and (5) type of insulation. For Part **II** see *Ceram. Abs.*, **22** [11] 199 (1943). B.C.R.

Complete gasification of coal. K. TRAENCKER. *Gas & Wasserfach;* abstracted in *Iron & Coal Trades Rev.*, **146** [3913] 318 (1943).—An analysis of the principal problems of the German gas industry leads to the conclusion that, in view of the marked increase in the demand for gas, future calls for gas can be met only by the adoption by mines of a process for the complete gasification of coal, such as has already been used in the production of synthetic gas. Gas-coal output in the future will not meet the demand for gasmaking. M.HA.

Construction of kiln influences correct firing draft. J. G. SEANOR. *Brick & Clay Record*, **102** [6] 24–25 (1943).—The size and area of the stack and flue, floor openings, the mass of ware, the throat formed by the bag wall, and the size and location of fireboxes are controlling factors in kiln circulation. The draft used gives little indication of the kiln firing, the crown temperature being a better index

* Obtained from microfilm.

to the volume of air circulated than a draft gauge in the stack. B.C.R.

Development of ceramic firing. T. H. KERR. *Ohio State Univ. Eng. Expt. Sta. News*, **15** [4] 6–9 (1943).—Ceramic firing has developed independently in more than one place, and various types of kilns have been built. Wood was the first fuel used; other fuels are coal, coke, lignite, straw, oil, and gas. Oil and gas are commonly used for china or porcelain, and coal is used for brick, etc. The common round periodic kiln is hard to control. The tunnel kiln is easier to control and is more economical with fuel, but its fixed production makes it difficult to supply a fluctuating market. Whether or not a tunnel kiln has a muffle has little effect on the results obtained. If the gas has sulfur or dust in it, a muffle-type tunnel kiln is preferred. A small tunnel kiln will have automatic temperature control, but this is hard to use in a large kiln. The serviceability of a gas can be calculated from the function B.t.u. value/$\sqrt{\text{sp. gr.}}$ This value should be maintained within $\pm 5\%$ for satisfactory service. W.D.F.

Dry ice kills coal-pile fires. ANON. *Heating & Ventilating*, **40** [4] 67 (1943).—A new device for extinguishing coal-pile fires has been developed. Pipes with perforated tips are driven into the burning portion, and charges of 50 lb. of solid carbon dioxide are placed in the pipes. Gas liberated by the heat blankets the fire, and the chilling action of the dry ice reduces the local temperature. The same manufacturer supplies a hot-spot indicator which operates when the temperature rises to 150°F. This gives a 72-hr. advance warning because combustion cannot take place until higher temperatures are reached. M.R.

Dynamical treatment of the elements of heat. G. B. BROWN. *Phil. Mag.*, **33** [222] 543–51 (1942).—A derivation of the temperature scale, quantity of heat, and the mechanical equivalent of heat is suggested, formulated on the dynamical effects produced by heat. This derivation leads to a foundation of calorimetry based directly on the first law of thermodynamics. The treatment is contrasted with that of the usual classical development of these terms. An absolute temperature scale is derived, independent of the properties of any real gas. The operations described permit relating the work and heat quantities without recourse to reversible cycles, etc. S.Z.

Luminous radiation from hot gases. W. T. DAVID. *Nature*, **150** [3801] 291–92 (1942).—The question as to whether normal gases become luminous when heated is of the greatest importance in the physics and chemistry of flame gases. Weston's spectrograms from carbon monoxide-air flame gases and the higher temperature carbon monoxide-oxygen flame gases show that when hydrogen is added, the characteristic carbon monoxide-flame gas spectrum disappears even though the flame gas temperature is higher. With the addition of hydrogen, the carbon dioxide produced is much more normal because the latent energy in carbon monoxide-flame gases decreases with addition of hydrogen. G.A.K.

***Model law for the comparative testing of the reactivity of solid fuels.** S. TRAUSTEL. *Feuerungstechnik*, **31** [1] 1–8 (1943).—The laws of similarity are briefly explained, and their application to combustion and gasification processes, flow phenomena, reaction equilibria, and the kinetics of chemical reactions are discussed in detail; characteristic numbers and ratios are derived. M.HA.

Natural gas plays dual role in Kaiser magnesium plants. J. H. GUMZ. *Amer. Gas Assn. Monthly*, **25** [10] 400–401, 420 (1943).—Two processes are being used in California for the production of metallic magnesium, namely, the carbothermic and the ferrosilicon (or silicothermic). The first uses gas as a shock chilling agent and the latter uses gas as a fuel to produce furnace temperatures of 2000°F. and upward. Out of four Kaiser magnesium plants in California, three are supplied with natural gas. Kaiser's Permanente Cement Co. uses a large quantity of natural gas for firing several cement kilns; this gas, however, is used first in a carbothermic plant for shock chilling the magnesium. Owing to the addition of CO, the volume of gas flowing from the magnesium plant is increased but the heating value per cubic foot has been lowered about 70 B.t.u. At another entirely separate plant, natural gas is used to produce magnesium by the ferrosilicon process. This plant has 64 furnaces, each about 34 ft. long, 10 ft. wide, and 10 ft. high, constructed of insulating refractories. In a third plant, dolomite is calcined in rotary kilns prior to its use in the carbothermic and ferrosilicon plants. Natural gas is used to fire these kilns. M.R.

Natural-gasoline enrichment of producer gas for use in underfiring recuperative type Solvay coke ovens. W. O. KEELING. *Amer. Gas Assn. Monthly*, **25** [9] 375–77 (1943).—Results prove that, within certain limitations, natural gasoline is a suitable carburant for cold carburetting air or a low B.t.u. base gas. M.R.

***Oil and pulverized-coal burners, Lorenzen system.** F. NISTLER. *Feuerungstechnik*, **30** [2] 29–32 (1942).—To obtain quick combustion with a short flame, a burner was developed to mix fuel and air intimately by providing the burner head with vanes in such a manner that it is put in rotation by the incoming combustion air. The oil or pulverized-coal supply is controlled by a centrally located needle in the nozzle which is regulated by the position of the burner head more or less deep in the combustion chamber. This burner construction permits combustion with almost the theoretical amount of air without noticeable quantities of unburned gases. M.HA.

Practical significance of the physical constitution of coal in coal preparation. L. C. MCCABE. *Illinois State Geol. Survey Rept. Investigations*, No. 82, pp. 406–10 (1942).—The petrographic investigations of coal of the last two decades have stimulated applied research in the field of preparation and utilization. Definition of the different types and varieties of coal was followed by the accumulation of a body of information on the specific characteristics. Differences in specific gravity, conductivity, and friability have been utilized in commercial and laboratory preparation to separate coals into their component parts. The availability of quantities of the different types in concentrated form has made large-scale combustion research possible. Laboratory tests for ignition temperature, agglutinating value, and swelling index are being perfected and, when correlated with coking, briquetting, and combustion practice, will facilitate the solution of problems arising in these fields. G.A.K.

Pulverized-coal firing of rotary lime kilns. ANON. *Pit & Quarry*, **33** [3] 52–56 (1940).—Modern lime production has two prime requisites, (1) control of quality and (2) flexibility of production. Pulverized coal as a fuel lends itself to these requirements. The experience of handling this fuel in other industries may be utilized by the lime industry. The application of pulverized coal to the burning of lime is discussed under the following headings: (1) power requirements, (2) reliability, (3) maintenance, (4) soundproofing, (5) coal drying, (6) coal-mill feeding, (7) coal fineness, (8) coal pipes, (9) fire rings, (10) proper sizing at feed end of kiln, (11) impurities in kiln feed, (12) analysis of slag ring, (13) flame placement, (14) slag-ring prevention by use of a basic refractory, (15) other methods for removing fire-ring slag, and (16) coal. M.R.

Radiation from flames. W. T. DAVID. *Nature*, **150** [3805] 407–408 (1942).—It has been generally thought that carbon dioxide radiates more powerfully than water vapor, but the opposite is true. Water vapor has twice as much radiating power as carbon dioxide under similar conditions. The greater proportion of the radiation from flames comes not from the interconal gases but from hot products surrounding the outer cone. The more rapid the combustion, the more turbulence exists in these products, and, because of the more effective intermingling with the surrounding air, the more rapid the cooling. G.A.K.

***Secondary air supply: arrangement of nozzles with particular consideration of the Bader system.** W. GUMZ. *Feuerungstechnik*, **30** [2] 32–36 (1942).—Secondary air supply is advantageous for gas-rich fuels to avoid heavy smoking, but it is also of advantage for gas-poor coals if the

* Obtained from microfilm.

* Obtained from microfilm.

nozzles are properly dimensioned and arranged. The amount of the air blown in by the secondary nozzles must be so limited that the total excess air is not increased and cooling of the grate by the primary air is assured. Pressure and escape velocity of the secondary air must be high enough to let the latter penetrate sufficiently far into the combustion chamber. The best place to introduce the secondary air is immediately above the fuel bed, as exemplified by the Bader system. M.HA.

Setting a zigzag kiln. ANON. *Brit. Clayworker*, **50** [598] 112–13 (1942).—Illustrated. V.R.E.

Symposium on gas generators: (1) Design of sprays and burners. R. A. HANSON. Presented at Production Conference of Pacific Coast Gas Assn.; abstracted in *Gas*, **19** [3] 27–28 (1943). **(2) Conversion of water-gas machines.** J. E. KELLEY. *Ibid.*, p. 29.—A carbureted water-gas set was converted to a high B.t.u. oil-gas generator by removing the grate bars and installing brick piers to support $4^1/_2$- x 9- x 18-in. generator tile and checker-brick. No change was made in the carburetor checker-brick, which had 16 courses of standard checker-brick laid so that they had a $2^1/_2$-in. open flue. After removing the checker-brick from the superheater, an arch 9 ft. 6 in. from the bottom of the shell was installed, and brick piers were built in as for the generator. Above the arch were 19 courses of checker-brick laid for a 3-in. staggered flue. The generator produced 13,446 cu. ft. of gas per hr. per 1000 checker-brick. **(3) Pressure drop in checker-brick.** R. A. DUNKLE. *Ibid.*, p. 30.—A method of calculating pressure drop in oil-gas generator checker-brick based on fundamental flow equations is described. R.G.C.

Temperature of flame gases. W. T. DAVID. *Nature*, **152** [3853] 278 (1943).—In open flames, temperature is generally assumed to be that acquired by a thermometric substance immersed in them (after correction for radiation loss). Temperatures shown in the following table indicate differently:

Combustible gas in mixture	(%)	Temp. measured by: Quartz-covered wire	Plain wire	Difference
CO*	20	1210	1420	210
CO*	25	1350	1650	300
CO*	29.6	1470	1850†	380
CO*	55	1350	1350	0
CO*	60	1260	1260	0
CH_4	7.5	1250	1440	190
CH_4	8.5	1320	1600	280
CH_4	9.47	1380	1730	350

* CO contained 1% hydrogen.
† Slightly extrapolated.

There would have been little difference between the temperatures measured by the two wires had the flame gases been just hot normal gases. A thermometric substance immersed in flame gases may be heated as a result of (1) their true temperature, (2) the unloading of latent energy on the surface, or (3) recombination of the abnormally dissociated products on the surface, provided it is of a type that promotes surface combustion. See "Abnormality. . .," *Ceram. Abs.*, **22** [1] 16 (1943); "Temperature. . .," *ibid.*, **21** [1] 22 (1942). G.A.K.

Temperature of hot flames. F. J. HAVLICEK. *Z. Tech. Physik;* abstracted in *Iron & Coal Trades Rev.*, **146** [3910] 194 (1943).—The problem of temperature in hot flames is analyzed; these temperatures are determined by the specific heats of the products of combustion, their dissociation, and thermal exchanges by flame radiation. An investigation of the temperature of a carburized flame in medium open-hearth furnaces is also reported. M.HA.

What's happening inside your kiln? XV, Radiation and conduction. L. R. WHITAKER. *Brick & Clay Record*, **103** [1] 23–24 (1943).—The basis for determining the correct amount of draft for a kiln depends on kiln characteristics and type of fuel used. Distribution of heat throughout the kiln by means of convection, radiation, and conduction is discussed. **XVI, Kiln atmosphere.** *Ibid.*, [2] 16–18.—Excess air passing through the fuel bed should not be considered detrimental if the resultant volume of air is at the proper temperature, as this increases the volume of hot gases passing through the kiln. The objections to admitting air over fires are mentioned. By maintenance of an oxidizing atmosphere and a high crown temperature, no overfiring resulted and a shorter run could be made. **XVII, Firing methods.** *Ibid.*, [3] 20–21.—Proper firing methods are discussed. The use of pyrometers for determining kiln temperature is preferable to judging temperatures by sight. For Part **XIV** see *Ceram. Abs.*, **22** [11] 200 (1943). B.C.R.

Why preheaters for rotary lime kilns? T. C. TAYLER. *Pit & Quarry*, **33** [11] 62–63 (1941).—An analytical discussion of heat transmission is presented. A preheater is not to be considered as just another way to obtain the same effect as adding to the length of the kiln, but it can be added to an existing short and inefficient rotary kiln. The advantages over longer kilns are (1) increased output, (2) less coal burned per ton of output, (3) lower operating and maintenance costs, and (4) better quality of product. M.R.

SEPARATE PUBLICATIONS

Analyses of West Virginia Coals. ANON. *U. S. Bur. Mines Tech. Paper*, No. 626 (1942). Supt. of Documents, Washington, D. C. Price 45¢.—The geologic structure of the coal basins, typical mining conditions in different districts, and outstanding economic data of industry are described. Principal facts regarding occurrence, reserves, quality, characteristics, production, and uses of W. Va. coals are also given. R.A.H.

Various B.t.u. Values of a Coal. J. F. BARKLEY AND L. R. BURDICK. *U. S. Bur. Mines Information Circ.*, No. 7193, 26 pp. (Dec., 1941). Free.—There are various ways of considering the B.t.u. value of coal. It is ordinarily expressed as the B.t.u. per pound (1) "as received" or "as sampled," (2) "moisture free" or "dry," (3) "moisture- and ash-free," (4) "H" value, (5) dry, "mineral matter free," and (6) moist, "mineral matter free." For any one coal sample, all these values are related by values of the chemical analysis of the coal. If the moisture, ash, and sulfur contents are known, any value may be calculated from any other. Data are given on many coals studied. R.A.H.

Geology

Attempt of identification of various bentonites. H. ERBRING AND H. LEHMANN. *Kolloid-Z.*, **103** [2] 126–29 (1943).—Tests used for obtaining characteristic values for bentonites include determinations of swelling, thixotropy, sedimentation, exchange absorption, electronmicrographs, viscosity, etc. Viscosity determinations are generally made on aqueous suspensions. This presents considerable difficulties because the concentrations of bentonite of necessity must be kept very low. The authors determined the viscosity of bentonite suspended in cyclohexanol. Although bentonite swells in this liquid, greater concentrations can be used than in water. The viscometer used has been described in detail by H. E. Erbring, S. Broese, and H. Bauer (*Kolloid-Beihefte*, **54**, 372 (1943)). With this viscometer, determinations were made on a U. S. bentonite from Wyoming, an Italian bentonite from Ponza, and a German bentonite from Geisenheim. The concentrations used were 25, 30, 35, and 40% for the U. S. and German bentonites and 25, 27, 30, and 32% for the Italian bentonite. The results of these determinations are tabulated and

presented on graphs. The U. S. and the German bentonites are very similar, whereas the Italian bentonite is considerably finer and swells even in cyclohexanol considerably more. It should be pointed out that the swelling capacity (Enslin value) of the Italian bentonite is approximately 400 to 500, whereas that of the U. S. and German bentonites is approximately 600 to 800. Very finely subdivided opal silica found in the Italian bentonite up to 30% is largely responsible for its lighter color as well as for its other properties. M.Ho.

Calcite-dolomite staining test. W. S. TANGIER-SMITH. *Econ. Geol.*, **38** [5] 420–22 (1943).—A staining test, consisting of a 5- to 10-sec. immersion of the sample (−60 +100 mesh) in a 2½% $FeCl_3$ solution, washing, a 10-sec. immersion in an $(NH_4)_2S$ solution saturated with H_2S, and a final washing with water was applied to (1) limestone from Carthage, Mo.; (2) typical fresh gray dolomite containing no calcite from Joplin, Mo.; and (3) pure pink dolomite crystals. The limestone acquired a normal black color. About 60% of the grains of the gray dolomite blackened, whereas they should have remained uncolored; of the remaining 40%, each of the grains was partially gray and black. The pink dolomite was blackened to an extent of 3 to 4%. The ammonium sulfide, when used alone with the gray dolomite, caused a decided darkening of all the grains, although it had no noticeable effect on the limestone. It is believed that a very weak solution of iron sulfate acting over a long period has resulted in an alteration in the ore body that renders this staining method useless for distinguishing between calcite and dolomite in ores of the Joplin, Mo., district. B.C.R.

Caliche: its mining and uses. J. A. RICKARD. *Pit & Quarry*, **34** [4] 46, 52 (1941).—Caliche, a substance native to the southwestern U. S., is a sedimentary lime containing more or less clay or a clay deposit containing more or less lime. The most common use of caliche is in the construction of highways. Its use for building blocks has been started, one small dormitory building having been built on the campus of the Texas College of Arts and Industries. Illustrated. M.R.

Chemical analyses of some Indian feldspars. M. L. MISRA. *Trans. Indian Ceram. Soc.*, **2** [1] 11–13 (1943).

Chemical lime in central Pennsylvania. G. MARSHALL KAY. *Econ. Geol.*, **38** [3] 188–203 (1943). B.C.R.

Chemical relationship of cryptomelane (psilomelane), hollandite, and coronadite. JOHN W. GRUNER. *Amer. Mineralogist*, **28**, 497–506 (1943).—The minerals cryptomelane, hollandite, and coronadite are isostructural and form isomorphous mixtures. The unit cell of the group contains 16 O ions. Its formula is $Mn^4{}_{8-(x/2+y/4+z/8)}(Mn^2,R^2)_x(K,Na)_y(Ba,Pb)_zO_{16}\cdot(H_2O)_{2-(y+z)}$. K, Ba, and Pb occupy identical positions. The ratio of $x:y:z$ is dependent on the state of oxidation of Mn, which in turn depends on the conditions under which the mineral forms. H_2O occupies positions which could be filled by K, Ba, or Pb, provided electrostatic balance is maintained. The mineral called "romanechite" by Lacroix has been found to consist of minute crystals of cryptomelane. W.D.F.

Feldspar-grinding plant in North Carolina. ANON. *Eng. Mining Jour.*, **144** [8] 73–75 (1943).—The Minpro plant is in the Spruce Pine region. The feldspar comes from a large group of mines. The recovery of feldspar from a mine is usually 25% or even less. The plant has 42 bins for 20 grades of crude feldspar. The feldspar is crushed and dried. It may go to a mixing bin or through rolls and screens, over a magnetic separator, and to one of 29 bins. The content of each bin is analyzed before use. An order for a certain grade of feldspar is filled by mixing the contents of these bins and grinding according to specifications in the finished grinding department, which comprises ball mills, tube mills, screens, and air separators; a dust-collecting system has been installed recently. Most shipments are made in bulk. Native granite block is used in the mill liners. The capacity is 125 tons per 24 hr. W.D.F.

Florida bog supplies material yielding commercial diatomite. ANON. *Pit & Quarry*, **34** [6] 48–49 (1941).—The American Diatomite Corp. is producing diatomite of fresh-water origin in central Florida. The deposit is located in a bog and varies from 4 to 20 ft. in thickness. A production of 4 tons daily is divided into several grades of material. Plant procedure is discussed. M.R.

Fluorspar separated by flotation at new plant in Illinois-Kentucky field. W. E. TRAUFFER. *Pit & Quarry*, **33** [11] 39–42 (1941).—About 80% of the Western Hemisphere's fluorspar comes from the Illinois-Kentucky field. The Mahoning Mining Co., subsidiary of the Youngstown Sheet & Tube Co., opened a new plant at Rosiclare, Ill., in July, 1939. A description of the plant is given with mention of various pieces of equipment. The property produces zinc and lead with the fluorspar, which raised a difficult separation problem. The U. S. Bureau of Mines cooperated by developing a method of separation by flotation. Eleven hundred tons of raw ore are treated per week by froth-flotation methods, and 400 tons of acid-grade fluorspar, 70 tons of metallurgical-grade fluorspar, 150 to 200 tons of zinc sulfide, and 50 tons of lead sulfide are produced weekly. M.R.

Layered or banded chromite. W. D. JOHNSTON, JR., AND H. CAPPER A. DESOUZA. *Econ. Geol.*, **38** [4] 287–97 (1943).—Chromite at Campo Formosa, Bahia, Brazil, occurs in layers several millimeters to a meter or more in thickness alternating with layers of serpentine derived from olivine. Where not disturbed by faulting, individual layers of both chromite and serpentine are remarkably persistent, both in thickness and extent. The resemblance to a sedimentary rock is so strong that the suggestion is made that these layered rocks were formed by the settling of alternate showers of chromite and olivine crystals on the floor of a magma chamber. Chromite concentrates obtained by separation in heavy liquids analyzed Cr_2O_3 56.2 to 58.6, Al_2O_3 11.1 to 12.4, Fe_2O_3 3.5 to 4.4, FeO 12.1 to 13.3, MgO 12.5 to 13.6, MnO 0.15 to 0.37, TiO_2 0.15 to 0.19, CaO 0.4 to 0.12, SiO_2 0.22 to 0.38, and H_2O 0.26 to 0.44%. B.C.R.

Lime, phosphate rock, other minerals have busy year supplying war demand. ANON. *Pit & Quarry*, **34** [7] 95–101 (1942).—A review of the past year covering lime, industrial sand, phosphate, magnesite, bauxite, mineral wool, asbestos, and gypsum is presented. M.R.

Magnesium—critical war metal. H. A. STELLEY. *Pit & Quarry*, **36** [2] 49–54 (1943).—S. describes briefly the three processes used in the production of magnesium: (1) electrolysis (originally used by Bunsen), (2) Hansgirg, and (3) ferrosilicon. The Basic Magnesium, Inc., plant at Las Vegas, Nev., is the world's largest; it uses the first method in producing magnesium, and its capacity is 150,000 tons of magnesium oxide per year. The plant is described and others are mentioned. M.R.

Maybe it's bentonite in your clay that makes it hard to handle. C. M. FURGASON. *Brick & Clay Record*, **103** [3] 22–26 (1943).—The undesirable working properties of some Texas clays can be attributed to the amount of bentonite present. The amount of bentonite or bentonitic material varies widely in different clays. The action of bentonite may be controlled by (1) calcination at 600°C. or higher, (2) the use of a drilling mud containing 25% or more sodium silicate solids by weight to prevent swelling, and (3) blocking the clay layers in the position they assume after separation by planar water to prevent their contraction on drying. The first two methods are believed to be too uneconomical for commercial use when manufacturing inexpensive clay products. B.C.R.

Mineralogy of the oxides and carbonates of bismuth. CLIFFORD FRONDEL. *Amer. Mineralogist*, **28**, 521–35 (1943).—Bismutite (Bi_2CO_5), supposedly a hydrate, contains only nonessential water. Heating bismutite and artificial $Bi_2CO_5\cdot nH_2O$ drives off water up to 290°C. where CO_2 is lost and α-Bi_2O_3 remains. Bismutosphaerite and basobismutite are identical with bismutite. Hydrobismutite and normannite are almost certainly identical with bismutite. Waltherite, a carbonate of bismuth of unknown formula, is a distinct species. The name "beyerite" is given to a new bismuth carbonate of unknown formula. It is proposed to restrict the name "bismite" to α-Bi_2O_3, and the first natural occurrence is described; it is mono-

clinic. The new name "sillenite" is given to isometric Bi_2O_3. A probable natural occurrence of $Bi_2O_3 \cdot 3H_2O$ is described. X-ray powder spacing data are tabulated for bismite, bismutite, sillenite, beyerite, and waltherite. W.D.F.

Natural potentials in sedimentary rocks. PARKE A. DICKEY. *Amer. Inst. Mining & Met. Engrs. Tech. Pub.*, No. 1625; *Petroleum Tech.*, **6** [5] 10 pp. (1943).—Potential differences between the strata of shale and sandstone have been recognized for about 15 years, and they form the basis of electrical logging of oil wells. Hitherto, these potentials have been ascribed solely to electrochemical reactions caused by the disturbing effects of the water in the drill hole through which they are generally measured. Observations by D. in wells empty of water and in a mine shaft suggest that potential differences between sandstones and shales are natural and specific properties of the rocks, although they are modified in measurement by the disturbing effects of the water in the drill hole. The cause of the potentials probably is to be sought in the relative polar adsorptive capacities of quartz and clay particles. W.D.F.

New data on agricolite, bismoclite, koechlinite, and the bismuth arsenates. CLIFFORD FRONDEL. *Amer. Mineralogist*, **28**, 536–40 (1943).—Agricolite is identical with eulytite, $Bi_4Si_3O_{12}$. Rhagite is identical with atelestite. Arsenobismite from Tintic, Utah, is a valid species. A new but as yet unnamed bismuth arsenate is described. Two new localities are cited for both koechlinite and bismoclite. X-ray powder spacing data are tabulated for atelestite, arsenobismite, koechlinite, and for the new unnamed bismuth arsenate. W.D.F.

New effects due to anisotropy of colloidal particles. ROBERT E. D. CLARK. *Chem. & Ind.*, **62** [37] 348–50 (1943).—Bentonite clay is a negative colloid, the charge originating as a result of the dissociation of the OH groups attached to the aluminum atoms in the interior of the lattice structure. It is thus to be expected that the flat particles in an aqueous suspension will tend to arrange themselves in the plane of an anode, provided the potential gradient in the vicinity of the latter is sufficiently great; experiments confirm this hypothesis. The structure near the anode will become close packed so as to attain its minimum potential energy. The polarization observed is doubtless due to the fact that a close-packed laminar structure of bentonite particles offers great mechanical hindrances to the transport of ions at right angles to the plane of the molecules. Some striking consequences of the simple picture of bentonite suspensions arises in connection with lubrication, a new type of rectifying cell, and orientation of bentonite particles in the vicinity of the cathode. The results of anisotropy in colloidal particles suggest new and valuable tools for the study of colloidal systems and may well afford useful methods for characterizing proteins, clays, etc. R.H.B.

Nomograms for determination of apparent dips. S. H. SHAW. *Bull. Inst. Mining & Met.*, No. 443, pp. 1–3 (1941).—Diagrams are based on $\tan X = \tan Y \sin A$, where X = apparent dip in a vertical plane which makes a horizontal angle, A, with the strike of the bedding plane. Y is the true dip of the bedding plane. V.R.E.

North Carolina, a story of great achievement. ANON. *Mfrs. Record*, **112** [10] 51–79 (1943).—North Carolina produces approximately 300 minerals. Building stones have been produced for some time, but more recently clays and shales for the production of high-grade brick, building tile, and sewer pipe have become important. Kaolin deposits have been under development since 1855, although Josiah Wedgwood, as early as 1746, sent to North Carolina for the clay. This State has, for some time, been the largest producer of mica in the U. S. Feldspar, talc, and pyrophyllite are important parts of the mineral production. Kyanite, olivine, vermiculite, asbestos, tungsten, molybdenum, and spodumene are also important. The latter three minerals were recently found in North Carolina. The State's manufactures, electric power, highways and transportation, finance, etc., are also discussed. M.R.

Oregon chrome sands yield to magnetic separation. JOHN B. HUTTL. *Eng. Mining Jour.*, **144** [9] 62–65 (1943).—This deposit, about 15 ft. thick, is 350 ft. above sea level and contains 3 to 20% chrome. The overburden varies from several inches to several feet of sand and clay. The ore is mined with a Carryall scraper. At the concentrator the ore is crushed, ground, and screened; it then goes through a hydroseparator to the primary tables. The middlings go to secondary tables, and both concentrates go through flotation cells. The concentrator recovers 85% of the chrome and delivers a 25% chrome concentrate. The processing plant uses magnetic separators, produces a 40% chrome concentrate, and also recovers magnetite, ilmenite, and zircon as by-products. W.D.F.

Piney River plant processes Virginia aplite; mineral used in glassmaking. W. E. TRAUFFER. *Pit & Quarry*, **34** [3] 44–45 (1941).—This Virginia aplite deposit was first worked in 1938. A description is given of the plant and its equipment, with a discussion of the process employed. Photographs. M.R.

Potash industry meets domestic requirements. ANON. *Pit & Quarry*, **33** [11] 63 (1941).—The industry met all domestic demands during 1940, and with little hope for importations during 1941, it is expected that potash will remain off the list of critical materials. The U. S. production in 1940 was 658,249 short tons of potash salts, a 20% gain over 1939. In 1940, the first commercial production in the U. S. (from domestic ores) of sulfate of potash-magnesia was started. Much potash material comes from the region around Carlsbad, N. Mex. The 1940 crude ore production there was 1,200,000 tons, with 440,000 tons of refined and processed salts resulting. M.R.

Role of moisture in soil mechanics. R. K. SCHOFIELD. *Chem. & Ind.*, **62** [36] 339–41 (1943).—S. gives a brief account of soil mechanics as related to physical and chemical principles. Reference is made to the flocculation and deflocculation of clay particles by salts in solution. Subjects of particular interest are evaporation, water movement in soils, and pressure differences which cause the phenomenon of suction. R.H.B.

San Francisco plant produces variety of industrial minerals. ANON. *Pit & Quarry*, **33** [7] 84–85 (1941).—The plant of the Commercial Minerals Co., Inc., produces crushed and powdered barytes, bentonite, limestone, soapstone, fibrous talc, whiting, etc. Its equipment is discussed. M.R.

Shape and roundness of Lake Erie beach sands. F. J. PETTIJOHN AND A. C. LUNDAHL. *Jour. Sediment. Petrol.*, **13** [2] 69–78 (1943).—Shape and roundness analyses were made of size grades common to several samples from Cedar Point. Sphericity declined slightly and roundness considerably in the direction of sand shift. The feldspar content remained unchanged. G.M.H.

Sillimanite in South Carolina. ANON. *Eng. Mining Jour.*, **144** [8] 75 (1943).—Sillimanite has been found in the Piedmont district in schists near Pelzer and east of Greenville. It is intergrown with sericite in a quartz-sericite schist which also contains biotite and kaolinized feldspar. It occurs as prisms or needles $^1/_8$ to $^1/_2$ in. long. The schists are intruded by granite, and sillimanite is found only near the intrusions. About 10 to 20% of sillimanite is usually found. The sillimanite is obviously the result of contact metamorphic action. W.D.F.

Stability of minerals in sedimentary rocks. P. G. H. BOSWELL. *Quart. Jour. Geol. Soc. London*, **97** [386–88] lvi-lxxv (1942).—At the present time the problem of mineral stability is of the greatest importance to sedimentary petrologists. It is recognized that the present state of alteration of detrital minerals is dependent not only on alterations attending the decomposition of the parent rock but also on chemical changes which took place since deposition. The importance of grain size as a stability factor is emphasized; even the so-called resistant minerals are attacked by cold water if ground fine enough. Laboratory attempts to reproduce naturally etched surfaces on minerals have been successful. The problem of authigenetic minerals is discussed. S.Z.

Structural determinations from diamond drilling. JOHN B. MERTIE, JR. *Econ. Geol.*, **38** [4] 298–312 (1943).—Problems may arise in the geometrical determinations of

strike and dip from core drilling. If the stratigraphic or structural surfaces are plane, as the bedding planes of a homocline, two problems may exist, depending upon whether the drill cores do or do not penetrate to some recognizable horizon. The first is solved by a simple graphic interpolation and is not discussed in this paper. The second is solved for the most general cases of three non-parallel drill holes, no one of which is necessarily vertical. In this solution errors are necessarily present owing to (1) inaccuracies in the measurement of the initial directions and dips of the drill holes, (2) deviations of the drill holes from their initial directions, and (3) inaccuracies in the measurement of the angles between the axes of the drill cores and the stratigraphic or structural planes. Error formulas are developed for the first and second cases for finding the final errors in the angles of strike and dip under certain specified assumptions. For curved surfaces, e.g., where folded beds are present, the same two problems arise, depending upon whether the drill holes do or do not penetrate to some recognizable horizon. In considering only the first of these problems, it is shown that nine drill holes are required to obtain a satisfactory solution. A method is described for obtaining equations to determine the strikes and dips. B.C.R.

Use of diatomite as a source of silica in ceramic glazes. WENDELL P. KEITH. *Bull. Amer. Ceram. Soc.*, **22** [11] 373 (1943).—2 references.

Vermiculite activity in North Carolina. ANON. *Pit & Quarry*, **33** [5] 49 (1940).—Vermiculite deposits are found in many parts of North Carolina. The most recent production is in Macon County near Franklin. The mineral is dug by hand and placed in burlap bags for shipping. M.R.

SEPARATE PUBLICATIONS

Annotated Geological Bibliography of Virginia. JOSEPH K. ROBERTS. Published by the Alderman Library, University of Virginia, Charlottesville, Va., 1942. 726 pp.—This most useful reference book contains sections on the rise and development of geological thought in Virginia and biographical sketches of Virginia geologists. The main part of the book (pp. 70–693) contains 2568 titles written by 938 named authors. The articles are arranged alphabetically by author. Each article is briefly but thoroughly abstracted. An index of 30 pp. makes the bibliography more useful. A.C.B.

Geology of the Nsuta Manganese Ore Deposits. H. SERVICE. *Gold Coast Geol. Survey Mem.*, **5**, 32 pp. (1943). Price 6s.—Gold Coast manganese is exported chiefly to the U. S. for battery, chemical, and metallurgical uses. The Nsuta property is the largest manganese-producing mine in the world and is located in dense jungle country, 39 miles from the port of Takoradi. The ore bodies occur in lenticles up to 1000 ft. in length and up to 100 ft. thick. The manganiferous zone is one of bands of gondite and manganiferous phyllite of pre-Cambrian age. This zone was folded, metamorphosed, and eroded in the interval between the Birrimian and the overlying Tarkwaian. The upper parts of the ore bodies were altered in Tertiary to recent times by surface waters which have produced a hard mammillary and stalactitic type of ore from which the quartz has been leached. This type of ore graduates downward through soft porous ore into hard, compact pyrolusite and psilomelane, where less leaching is in evidence. The ore is usually dull and black without apparent crystallinity, and the central parts of the ore bodies consist of friable black oxides with numerous voids. There is also a detrital ore consisting of masses of manganese oxides embedded in soil or clay. S. believes that these deposits, like those of Nikopol, originated as sediments and were enriched by meteoric waters. Illustrated. V.R.E.

Mineral Industry in 1942. ANON. *Mining Jour.* [London], Ann. Rev. Number, Appendix 15, 84 pp. (1943).—Price 1s 6d.—Gold, silver, nickel and platinum metals, tin, copper, lead, zinc, cadmium, magnesium, aluminum, bauxite, oil, the British coal industry, steel, and scientific apparatus and equipment are discussed. V.R.E.

Pyrophyllite. Published by the R. T. Vanderbilt Co., New York, Oct., 1943. 24 pp., illustrated.—This booklet gives brief information on the geology, properties, and ceramic uses of pyrophyllite. Nine pages are devoted to its properties, physical, pyro, chemical, and optical. Five pages are devoted to the use of pyrophyllite in ceramic compositions. The data are for the most part given in graphs. 21 references.

PATENTS

Aplite processing. R. F. BRENNER AND R. D. DUBBLE (Dominion Minerals, Inc.). Can. 415,296, Sept. 21, 1943 (Oct. 6, 1941; in U. S. Dec. 5, 1940).—A process for reducing the iron content of aplite comprises calcining aplite at a temperature of 1000° to 2500°F. for a time sufficient to render the iron content soluble in acids and then leaching with an acid for a time sufficient to dissolve most of the iron content while leaving the greater part of the alumina content unattacked. G.M.H.

Mining and recovery of potash compounds. ROY CROSS (Kansas City Testing Laboratory). U. S. 2,331,890, Oct. 19, 1943 (July 5, 1941).—A process of mining sylvinite from subterranean deposits and of recovering potassium chloride therefrom.

Chemistry and Physics

Absorption of phosphoric acid by soils. W. LAATSCH. *Kolloid-Z.*, **102** [1] 60–66 (1943).—The absorption of PO_4 was tested on Ca-permutite, Ca-montmorillonite, NH_4-montmorillonite, and clay-humus complexes. The respective complexes were shaken with an alkali phosphate solution for 8 hr. and then kept for 8 to 14 days. After this the supernatant clear liquid was analyzed. The experiments were made with increasing concentrations of phosphate solutions. Ca permutite absorbed PO_4 ion on its permutite surfaces. Even when the PO_4 ion concentration exceeded by far the concentration encountered in soils, no Ca phosphate precipitate was found in the solution. Ca montmorillonite, like K and NH_4 montmorillonite, absorbed considerable quantities of PO_4 ion. From an alkali phosphate solution of a concentration comparable to that encountered in soils, montmorillonite absorbed only the PO_4 ions but not the alkali. When the concentration in the solutions exceeds that in the soil, the amount of PO_4 ions absorbed increases with increasing concentration and both ions are absorbed. The absorptive capacity of clay for PO_4 ion is greatly diminished when the clay is coupled with humic acids. In soils, part of the phosphate may also be fixed by phosphate-precipitating cations found within the soil. M.Ho.

Acid-base relationships at higher temperatures. L. F. AUDRIETH AND T. MOELLER. *Jour. Chem. Education*, **20** [5] 219–22 (1943).—The Lewis and Brønsted concepts of acid and base are applied in a general way to neutralization reactions at higher temperatures. No attempt is made to evaluate the validity of the two concepts. Various examples from industrial processes are discussed. A detailed bibliography on the acid-base concepts is given. S.Z.

Anomalous heat absorption of kaolinite. F. H. NORTON AND W. G. LAWRENCE. *Jour. Amer. Ceram. Soc.*, **26** [11] 388–89 (1943).

Clay used to save proteins. ANON. *Science News Letter*, **44** [12] 182 (1943).—Between 1/3 and 1% bentonite added to distillery wastes attracts protein molecules apparently electrically. The mass forms a precipitate which is easily filtered off. Extremely little protein remains in the liquid passing through the filter. G.A.K.

Coordination and valence. A. A. BLANCHARD. *Jour. Chem. Education*, **20** [9] 454–60 (1943).—There is a trend to use the word "valence" to mean the oxidation or reduc-

tion number of a compound rather than the combining power of the atom. Thus the valence of Cr in $Cr(CO)_6$ is 0 while the valence of Au in $(Au(CN)_2)^-$ is 1. The valence of the central atom in a coordination complex depends upon the coordination. The effect of coordination on valence can be estimated by (1) the electrode potential, (2) the half-wave potential on a polarograph, and (3) the complex compound formula. These estimations are discussed in detail. The stability of a complex is affected by numerous factors, such as gaseous ions in solution, valence of the central ion, symmetry and distribution of masses and charges, resonance, chelation, and other considerations. Examples of inorganic and organic compounds are given. S.Z.

Electrochemical properties of mineral membranes: II, Measurement of potassium-ion activities in colloidal clays. CHARLES E. MARSHALL AND W. E. BERGMAN. *Jour. Phys. Chem.*, **46**, 52–61 (1942).—Complete titration curves of the H-ion and K-ion activities of potassium agar and of samples of the three types of clay (montmorillonite, mica, and kaolinite) are given. Potassium agar behaves as a typical strong electrolyte. The clays behave similarly to weak monobasic acids, but the capacity of kaolinite for rendering potassium inactive is less than that of the other clays. No ionic interaction between the active potassium of a clay and potassium ions added in true solution was apparent. For Parts **III** and **IV** see *Ceram. Abs.*, **22** [6] 108 (1943); for Part **V** see *ibid.*, **21** [10] 223 (1942). R.A.G.

Elimination of sorption-desorption hysteresis in hydrous oxide systems: I, Silica. H. B. WEISER, W. O. MILLIGAN, AND J. HOLMES. *Jour. Phys. Chem.*, **46**, 586 (1942).—Water sorption and desorption curves for silica gel prepared from water glass and from sodium metasilicate under various conditions are given, and the effects on the hysteresis loop are discussed. Increasing the temperature of precipitation of silica gel from water-glass solution causes a marked drop in the hysteresis loop. A much smaller decrease is observed with gels formed from fresh hot sodium metasilicate solutions. This difference is due to the much larger amounts of colloidal silica in the solutions of water glass than in solutions of fresh sodium metasilicate. The various theories of gel structure are discussed in the light of these results. R.A.G.

Fluorspar analysis. G. L. FRAYSER. *Deco Trefoil*, **7** [2] 5 (1943); *Chem. Industries*, **53** [3] 376–77 (1943).—A review of three methods. The Willard-Winter method involves distillation. A 0.2-gm. sample with 30 ml. water and 25 cc. of perchloric acid is placed in a 250-ml. Claisen flask and distilled until the temperature reaches 135°C. Steam is then admitted to keep the volume constant, and the distillation is continued at 135°C. until 250 ml. of distillate is collected in a volumetric flask. Take a 100-ml. aliquot and adjust with 2% NaOH and 0.5% HCl with 0.05% sodium alizarin sulfonate until the pink color is just discharged. Add 1 cc. of buffer solution (9.488 gm. of monochloroacetic acid and 2 gm. of NaOH in 100 cc. of water) and titrate with 0.1 *N* thorium nitrate to a permanent pink; 1 cc. of 0.1 *N* thorium nitrate equals 0.0019 gm. of fluorine. This method has been adapted to fluorspar ores because none of the impurities such as sulfides, clays, micas, and barytes interfere with the fluorine determination. An ore which is rich in sulfide will produce a cloudy distillate, but this can be overcome by making it alkaline and filtering. The method of Lenher Schwerin ("Fluorspar . . .," *Ceram. Abs.*, **19** [10] 242 (1940)) is a rapid one for determining carbonates, calcium fluoride, and silica in fluorspar containing no sulfide. It gives high fluorides in the presence of mica schists. Digest a 0.5-gm. sample, ground fine, with 10 cc. of 10% acetic acid for $1^1/_2$ hr. on the steam bath. Filter, wash, and ignite. The loss is carbonates. To the residue add 15 ml. of 20% perchloric acid saturated with boric acid at 50°C. Heat until fumes of perchloric acid are given off for 5 min. Add 10 ml. water and fume 5 min. Dilute to 50 ml., boil, and filter. Wash with dilute perchloric acid and then with hot water. Ignite the residue with H_2SO_4 in platinum. The loss in weight is CaF_2. The method of Bidtel (1913) is useful for high-grade ore only. E.D.M.

Frictional phenomena: XIII. ANDREW GEMANT. *Jour. Applied Physics*, **14** [5] 204–16 (1943).—G. discusses (1) the quantitative definition of losses within vibrating solids; (2) experimental methods for their determination, results obtained on different materials, and empirical rules derived; and (3) the chief mechanisms leading to internal friction, viz., thermal and plastic processes, and the physical basis for the observed losses. **XIV.** *Ibid.*, [6] 258–70. —Technical applications of solid friction concepts are discussed. For Parts **XI** and **XII** see this issue, p. 8. A.P.

How to obtain accuracy in sampling. CHARLES DEMOND. *Rock Products*, **46** [5] 65–66, 92 (1943).—D. describes an experimental method of determining the proper amount of material of a given size to be used for a predetermined accuracy in test results, according to the formula $W = kD^a$. A sampling mill is described. B.C.R.

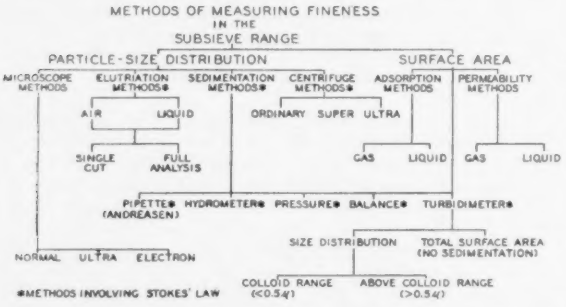
Improved counting procedure for determining the number of particles. EDUARD M. GALVEZ LAGUARTA. *Kolloid-Z.*, **102** [3] 268 (1943).—To eliminate psychological errors in counting particles under an ultramicroscope, L. suggests interrupting the illumination periodically. The interrupting mechanism is connected with a metronome. M.Ho.

Ionic exchange in colloidal sulfur: I, Contribution to the knowledge of ion exchange in lyophobic colloidal systems. E. O. K. VERSTRAETE. *Kolloid-Z.*, **102** [3] 251–67 (1943).—This is an introductory work to an investigation of ionic exchange in sulfur sols. Colloidal sulfur was prepared by the Raffo and the Selmi methods. The former follows the reaction $Na_2S_2O_3 + H_2SO_4 \rightarrow S + SO_2 + Na_2SO_4 + H_2O$, and the second, $SO_2 + 2H_2S \rightarrow 3S + 2H_2O$. In both cases a number of polythionates, free and fixed acids, and salts are formed. A quantitative method for determining the polythionates was worked out. The degree of dispersion of the sol was determined by count in a dark field. The coagulation value of a number of cations and anions was determined. **II.** *Ibid.*, **103** [1] 25–42 (1943).—The ion exchange between a S sol and various electrolytes was determined quantitatively. The details of the procedure are described. The exchanging ion was H^+. Only seldom does the exchange parallel the addition of the electrolyte. The order of replacing ability of the monovalent ions is K > Na > Li. This order for bivalent cations is Ba > Sr > Ca > Mg. Al^{+++} induces flocculation before it completely replaces the opposing ion. In this respect, Th^{++++} is less effective than Al^{+++}. Apparently not all the valencies of tetravalent Th participate in the flocculation. Hexavalent hexol ion was found unsuitable for quantitative determinations, for it decomposes in an acid medium. The antagonism between H and Na ions and the other cations was investigated. Generally, the bivalent cations are more antagonistic than the monovalent cations. The antagonistic activity of the bivalent ions is arranged in a lyotropic series. Mg ion is the most antagonistic. The pair H–Al is very strongly antagonistic, while H–Th is mildly so. The antagonism is milder toward Na^+ than toward H^+. The pair Na–K shows almost no antagonism. The order in which the electrolytes are added is of importance; when the bivalent cation is added first followed by the monovalent cation, the antagonism ceases or is greatly reduced. The antagonism phenomenon is discussed. Such factors as the activity of the cations and their hydration, polarizability, and adsorption capacity affect their antagonism. M.Ho.

Molecule of calcium carbonate. ANON. *Chem. & Ind.*, **62** [38] 353 (1943).—The structure of $CaCO_3$ is apparently complex, and therefore it cannot be represented as a cube in the strict sense. The reason for this lies in the carbonate radical. Each carbon is bound to three oxygens. Such binding is not confined to the cubic (or nearly cubic) cells but goes from one edge of the solid body of calcium carbonate to the boundaries of the body in all directions. In view of this it is thought that "molecule" is not an appropriate term for such a solid body as calcium carbonate or for the majority of solids. The explanation of the

structure of $CaCO_3$ may be found with the aid of fractional bonding relationships. At present, the printed two-dimensional figure is inadequate for picturing the $CaCO_3$ arrangement. R.H.B.

Measurement of the fineness of powdered materials. P. J. RIGDEN. *Chem. & Ind.*, **62** [42] 393–96 (1943).—Methods and formulas are given and illustrated.



Permutoids. HANS KAUTSKY. *Kolloid-Z.*, **102** [1] 1–14 (1943).—Permutoids are defined as more or less orderly structures consisting of unidimensional chains, two-dimensional nets, or three-dimensional assemblies. The structure of permutoids is very loose so that liquids and gases can penetrate them and alien molecules can react with the individual groups constituting the chains, nets, or assemblies of the permutoids. Siloxene ($Si_6H_6O_3$) and its derivatives are used as examples to explain the behavior of permutoids. An analogy is drawn between siloxene and high molecular inorganic and organic substances and biological structures. Permutoids are formed either through a degradation of crystalline lattices, such as plane and fibril lattices, or through a building up process (condensation, polymerization) of primary chains and nets of high molecular substances. The degree of order or disorder of permutoids can be altered deliberately by swelling or shrinking or by adding suitable substances in their compounding. The internal maximum subdivision of a substance having a permutoid structure remains unaffected. In the case of siloxene, this was proved by quantitative measurements of adsorption. Furthermore, it was possible in the case of siloxene and its derivatives to establish the relation between molar surface and adsorption and the influence of substituents on molar adsorption. The rate of chemical reactions in permutoids is quite rapid, and they usually result in stoichiometric products. This is amply illustrated by siloxene and its many derivatives. Exothermic reactions induced by light or other accelerators have a rapid rate in the elementary chains and nets of permutoids, as shown by the rapid halogenation of siloxene in light and in the presence of traces of oxygen. The explosiveness of oxysiloxene and of compounds derived from siloxene and oxyacids in the presence of oxygen corroborate this theory. The siloxene ring is a chromophor, and groups such as OH, NH_2, etc., attached to it act as auxochromes. The colored derivatives of siloxene are luminescent. These compounds are effective energy transformers and are capable of transforming photoenergy into chemical energy and vice versa. This is shown by the transformation of chemiluminescence induced by oxidation of elementary nets into light. Fluorescent dye molecules can be attached to nonluminescent reactive siloxene derivatives; then, by oxidizing the Si compound, the characteristically fluorescent spectra of the dye are produced as chemiluminescence. The concept of permutoids is further elucidated by the example of an individual permutoid. Si is used as the example. The permutoidal structure of Si consists of elementary lamellas. Unlike high molecular substances, they do not comprise a plurality of chemically identical groups but rather planar elements having an individual chemical make-up. This permits manifold chemical phenomena, each of which is confined to a certain group and localized by it to take place in a permutoid configuration. This is of particular importance for the catalytic reactions and energy transformations in biological metabolism such as take place simultaneously in great complexity and in the extremely confined place of plasma. M.Ho.

Phase equilibrium in the system $Li_2O \cdot Al_2O_3$–SiO_2. ROBERT A. HATCH. *Amer. Mineralogist*, **28**, 471–96 (1943).—Liquidus and solidus temperatures for 21 preparations in the system $Li_2O \cdot Al_2O_3$–SiO_2 from 85 to 22% SiO_2 were determined. Three-component compounds are β-spodumene ($Li_2O \cdot Al_2O_3 \cdot 4SiO_2$), the high-temperature form, which melts congruently at 1423°C., and β-eucryptite ($Li_2O \cdot Al_2O_3 \cdot 2SiO_2$), which melts with dissociation at 1397°C. No compounds having the composition of petalite ($Li_2O \cdot Al_2O_3 \cdot 8SiO_2$) or $Li_2O \cdot Al_2O_3 \cdot 6SiO_2$ are stable above the solidus. Petalite dissociates at 950°C. or below. This system includes (1) the silica field, (2) the field of β-spodumene-silica solid solution, (3) the field of β-spodumene solid solution, (4) the field of β-eucryptite solid solution, (5) the γ-alumina field, and (6) the lithium aluminate field (?). Fields 1 and 2 appear to be binary; fields 3 and 4 are essentially binary at the liquidus but show ternary behavior 10° to 80° below the solidus, small amounts of mullite and/or α-alumina separating from the solid solution series; field 5 is ternary. Attempts to synthesize α-spodumene, the mineral, hydrothermally at pressures below 100 atm. and at temperatures of 400° to 550°C. failed. In every case β-spodumene crystallized from the spodumene glass. W.D.F.

Reversible chromatic thermosensitivity. E. W. BLANK. *Jour. Chem. Education*, **20** [4] 171–74 (1943).—A purely descriptive tabulation is made of various substances that change color when heated to moderate temperatures. These substances include borax beads of various compositions and the special cases of chromates, ferrocyanides, and ferricyanides. The causes and the temperature range of the color change are not discussed. S.Z.

Silicates of the perovskite type of structure. H. J. GOLDSCHMIDT AND J. R. RAIT. *Nature*, **152** [3856] 356 (1943).—In an investigation of the constitution of steelworks slags and refractories, the authors found that a certain type of furnace slag differed in its X-ray diffraction pattern from the rest and was closely related to perovskite. It was identified as merwinite, $3CaO \cdot MgO \cdot 2SiO_2$, and its manganese analogue, $3CaO \cdot MnO \cdot 2SiO_2$. The pattern of merwinite corresponds to that of a pseudocubic unit cell as revealed by the splitting of the main cubic lines into groups and the appearance of additional reflections. The lattice spacing of the ideal cube of merwinite is 3.76 a.u. as compared with 3.81 a.u. for perovskite. G.A.K.

***Spectrum-analytical investigation of silica and alumina containing inclusions.** J. HEYES. *Mitt. Kaiser-Wilhelm Inst. Eisenforsch. Düsseldorf*, **24** [1] 1–6 (1942); abstracted in *Physik. Ber.*, **23** [9] 1010 (1942).—Inclusions can be examined by spectrum analysis by directing the spark through a perforated gypsum plate which is attached, e.g., by paraffin, to the specimen. The inclusions contain mostly nests of deoxidation agents. M.HA.

Spot-reaction experiments: I, Catalytic reactions. F. FEIGL. *Jour. Chem. Education*, **20** [3] 137–41 (1943).—Several subjects relating to spot reactions and their use in qualitative analysis are discussed in lecture form with detailed procedures for experiments. The catalysis of several oxidation-reduction reactions involving Mn and N are analyzed. **II, Reactions on a filter paper.** *Ibid.*, [4] 174–78.—The use of filter paper as a medium for spot reactions is discussed for several procedures including several sulfide topochemical reactions. **III, Heterogeneous reactions.** *Ibid.*, [5] 240–43.—The procedure is given for several solid-gas and solid-liquid reactions useful in qualitative analysis. The absorption of gases on finely divided platinum and reactions of K_2CrO_4 and MnO_2 with activated HCl are described. **IV, Protective-layer effects.** *Ibid.*, [6] 298–300.—Metals can be protected from attack by a protective metal coating or by being rendered passive. This isolation principle can also be applied to analytical reactions. The protective-layer effect of palladium dimethylglyoxime on nickel dimethylglyoxime is applied to the detection of palladium. **V, Solvents.** *Ibid.*, [6] 300–301.—

* Obtained from microfilm.

The influence of solvent on analytical reactions is discussed with the behavior of sulfur and iodine in various solvents as examples. See "Applications. . .," *Ceram. Abs.*, **22** [10] 182 (1943). S.Z.

Statistical handling of laboratory data. E. U. CONDON. *Product Eng.*, **14** [10] 615–17 (1943).—The principles and the application of statistical methods of evaluating the significance of conclusions or inferences derived by testing a sample lot of items are explained. M.HA.

Ternary system MgO–Al_2O_3–Cr_2O_3. W. T. WILDE AND W. J. REES. *Trans. Brit. Ceram. Soc.*, **42** [7] 123–55 (1943).—The authors investigated the components magnesia, alumina, and chromium oxide and their reaction products at temperatures up to fusion. The work may be summarized as follows: (1) The binary system Al_2O_3–Cr_2O_3 shows complete solid solution with no complicating factors. The precise positions of the solidus and liquidus phase boundaries remain to be determined, but no confirmation has been obtained of the abnormally high melting point, 2135°C., given by Bunting for chromium oxide. The suggestion that the more usually observed melting point of 2060° to 2080°C. is due to the formation of a lower oxide has been disproved by the demonstration that when reduction occurs, chromium metal is obtained in equilibrium with the sesquioxide. (2) The binary system MgO–Al_2O_3 possesses only one compound, $MgO \cdot Al_2O_3$, which can take a considerable amount of alumina into solid solution at high temperatures. No evidence has been obtained of any solid solution of magnesia in $MgO \cdot Al_2O_3$. Alumina is precipitated from spinel-alumina solid solution when cooling is slow. (3) The binary system MgO–Cr_2O_3 possesses one compound, $MgO \cdot Cr_2O_3$. So far no conclusive evidence has been obtained for the suggestion that this compound may take either magnesia or chromium oxide into solid solution; whatever solid solution does occur is negligible in furnace-cooled specimens. The evidence of the existence of the compound $4MgO \cdot Cr_2O_3$ has been reviewed, and on the basis of a thorough X-ray investigation of this part of the system it has been concluded that no stable compound of this formula exists. (4) In the high-magnesia portion of the ternary system, the lattice dimensions of the spinel compounds appear to depend solely on the relative proportions of chromium oxide and aluminum oxide present. In the low-magnesia portion, the proportion of magnesia present also has a slight effect. The diffuse nature of the pattern of the rhombohedral phase in the low-magnesia portion of the system suggests that precipitation in the solid state may be taking place as in the MgO–Al_2O_3 binary system, but this cannot yet be taken as fully proved. A complete series of solid solutions is formed between $MgO \cdot Al_2O_3$ and $MgO \cdot Cr_2O_3$. The series is not completely regular, and explanations of the irregularities are suggested. No ternary compounds are formed. R.A.H.

Theory of thixotropy. WOLF VON ENGELHARDT. *Kolloid-Z.*, **102** [3] 217–32 (1943).—The degree of thixotropy of a fine-grained solid varies with the liquid in which it is suspended. Degree of thixotropy is defined as the ratio of volume of liquid to volume of solid in a gel of 1 min. solidification time. For kaolinite systems, the thixotropic effect of certain liquids follows a definite order. Kaolinite is more thixotropic in nonpolar liquids, such as hexane and benzene, and less thixotropic in dipolar liquids. Among the latter, the thixotropy in the higher alcohols is the lowest. It is noteworthy that the same order was found for the abrasion hardness of quartz ground in various liquids. To determine abrasion hardness, quartz crystals were ground parallel to the plane (001). The crystal was held under constant pressure and ground for a definite time with a definite weight of silicon carbide suspended in various liquids. The abrasion hardness (*Schleifhärte*) is defined as the reciprocal value of loss of volume of the crystal per square centimeter of ground surface. The abrasion hardness of quartz in distilled water is taken as 100. Quartz is hardest in those liquids which impart the highest thixotropy to a system. The thixotropy of a system is higher, the greater the surface tension between the solid and the liquid phases. The close relation between these two phenomena becomes apparent from the theory of thixotropy and from a theoretical interpretation of the grinding effect. Between the solid particles of a thixotropic system exist attractive and repelling forces. The latter decrease more rapidly with distance; thus, the particles of a gel enjoy to some extent a forceless mutual relation. The distance between particles which corresponds to such a state determines the amount of liquid trapped in the gel. If the distance between particles is great, the amount of trapped liquid is great and the system has a high degree of thixotropy. These repelling forces are attributable to electric surface charges on the particles. The charges create an electric field around the particles and polarize the surrounding liquid. The stronger the interphase liquid is polarized, the shorter is the effective radius of the repelling force; consequently the shorter is the distance between the particles and therefore the smaller is the degree of thixotropy of the system. Therein lies the explanation of the relationship between thixotropy and the grinding effect. The solid-liquid surface tension and also the abrasion hardness are greatest in a liquid which is least polarized at its interphase, i.e., a liquid having the highest energy content at the interphase. Nonpolar liquids are least polarized, and therefore the abrasion hardness and thixotropy in such liquids are highest. Dipolar liquids are polarized in increasing measure the less they are associated, because the associated liquids have their dipoles as part of a larger spacial structure, and the dipoles are therefore not nearly so completely oriented in a field. Thus, the degree of association of a liquid has a direct bearing on the thixotropy of a system as well as on the abrasion hardness. Whereas the effect of liquids on thixotropy largely depends on the nature and spacial shape of the ultimate particle of the liquid, the effect of solids (taken for the same liquid) depends primarily on the shape of the particle. The opinions of other investigators, that anisotropic particles are more apt to show thixotropy than spherical particles, was confirmed by microscopic analyses of mineral particles by Winkler (*Kolloid-Beihefte*, **48**, 341 (1938)). This is readily explained by the fact that a gel of plate-shaped particles contains more liquid than a gel of spherical particles, assuming that the distance between the particles in both cases is the same. The distances between circular plates, when the attracting and repelling forces are in equilibrium, are of the same order of magnitude and are probably greater than between spheres of the same diameter. In the preceding statements it is assumed that the forces of attraction are those of Van der Waals, i.e., they depend on volume, and the repelling forces are due to surface charges. M.Ho.

Viscosity of suspensions: effect of strong electrolytes on the viscosity of starch and bentonite suspensions. A. v. BUZÁGH. *Kolloid-Z.*, **103** [2] 119–26 (1943).—The viscosity of aqueous suspensions of starch and bentonite at various concentrations was compared to that of similar suspensions of quartz. The concentrations at which these determinations were made were 1 to 20 gm. per 100 cc. of suspension. For suspensions with charged particles, the concentration vs. viscosity curve is convex to the abscissa (concentration). The same curve for particles at the isoelectric point is a straight line for quartz and starch suspensions, but it remains convex for bentonite. Suspensions of quartz and of starch have no structural viscosity either when their particles are charged or when the particles are at the isoelectric point. Bentonite suspensions have a definite structural viscosity both when the particles are charged and when they are at the isoelectric point. The viscosity of hydrophobic suspensions is affected by the charge on the particles and by the adhesion capacity of the particles. The viscosity of hydrophobic suspensions, in addition to these factors, is affected by the lyosphere. The correlation between viscosity, adhesion capacity, and migration velocity was investigated in the presence of strong electrolytes: $NaCl$, KCl, K_2SO_4, K_3PO_4, $K_3Fe(CN)_6$, $K_4Fe(CN)_6$, $BaCl_2$, $CuCl_2$, $MgSO_4$, $AlCl_3$, and $ThCl_4$. These electrolytes were used in concentrations of 0 to 100 millimol per liter. The activity coefficients of the solutions are computed. The adhesion capacity for bentonite could

not be determined. For starch it was measured by the slope angle (angle of repose) which was found to be affected similarly to the adhesion capacity. It is more convenient to use the tangent of this angle. The experimental results show that in the case of hydrophobic suspensions (quartz and starch), the effect of electrolytes on the viscosity is analogous to their effect on the adhesion capacity, i.e., the viscosity and the adhesion capacity both rise or diminish under the influence of the same electrolyte. At the isoelectric point, hydrophobic suspensions have their maximum viscosity and also their maximum adhesion capacity. The difference between quartz suspensions and starch suspensions lies in the fact that the former are affected by the cations, whereas starch suspensions are affected by both cations and anions. This fact becomes pronounced when considering the Ostwald activity coefficient. Whereas for quartz suspensions only the cationic activity coefficient is to be considered, for starch suspensions the anionic activity coefficient must also be considered. For bentonite suspensions no correlation exists between the viscosity and migration velocity when discharging of particles is accompanied by dehydration. Because of the lyosphere, the activity coefficient of the electrolyte has no bearing on the viscosity of bentonite suspensions. Therein lies the main difference between suspensions of hydrophobic and hydrophilic colloids.

M.Ho.

Vitreous state. MAURICE L. HUGGINS, KUAN-HAN SUN, AND ALEXANDER SILVERMAN. *Jour. Amer. Ceram. Soc.*, **26** [12] 393–98 (1943).—14 references, 1 figure.

X-ray patterns of hydrated calcium silicates. HOWARD F. MCMURDIE AND EINAR P. FLINT. *Jour. Research Nat. Bur. Standards*, **31** [4] 225–28 (1943); RP 1560. Price 5¢.—X-ray powder diffraction data of 15 hydrated calcium silicates are reported as a supplement to a previously published report ("Formation . . .," *Ceram. Abs.*, **18** [3] 83 (1939)) on the formation of these compounds. These data may be useful to workers on Portland cement hydration, boiler scale, etc., for the identification of phases.

R.A.H.

PATENTS

Anhydrous magnesium sulfate process. WALTER H. MACINTIRE (American Zinc, Lead & Smelting Co.). Can. 413,942, July 20, 1943 (Dec. 31, 1940; in U. S. Feb. 23, 1940). G.M.H.

Beryllium fluoride manufacture. CARLO ADAMOLI (Perosa Corp.). Can. 415,649, Oct. 5, 1943 (Oct. 8, 1937). G.M.H.

Dense soda ash. H. E. ROBERTSON (Solvay Process Co.). Can. 414,942, Aug. 31, 1943 (Nov. 18, 1940; in U. S. Jan. 10, 1940). G.M.H.

Determination of sodium hydroxide in presence of the aluminate. P. N. BURKARD (Wyandotte Chemicals Corp.). U. S. 2,332,497, Oct. 26, 1943 (Jan. 6, 1941).—The method of determining the amount of sodium hydroxide in a solution containing alkali-metal salts of weak acids in addition thereto and contaminated with sodium aluminate consisting in the steps of precipitating the alkali-metal salts, whereby the sodium hydroxide and sodium aluminate remain in solution, neutralizing the alkalinity of the hydroxide and the aluminate, adding sodium fluoride thereto in an amount sufficient to react completely with the sodium aluminate, thereby regenerating the alkalinity of the aluminate to twice its original amount, and then neutralizing the resultant solution.

Electrolytic process for the extraction of manganese. S. M. SHELTON (Metallic Manganese Co., Ltd.). Can. 414,149, July 27, 1943 (Oct. 10, 1936). G.M.H.

Magnesium production. H. R. DOERNER. Can. 415,252, Sept. 21, 1943 (Jan. 12, 1942). G.M.H.

Manufacture of zinc oxide. H. M. CYR (New Jersey Zinc Co.). U. S. 2,331,599, Oct. 12, 1943 (July 26, 1939).

Preparation of ferric oxide. F. W. BERK & CO., LTD., AND C. G. SIX. Brit. 555,681, Sept. 15, 1943 (April 20, 1942).

Production of chromium trioxide. C. N. SMITH (Carbide & Carbon Chemicals Corp.). U. S. 2,335,365, Nov. 30, 1943 (Aug. 14, 1941).—Process for making pure chromium trioxide which comprises reacting a chromate of an insoluble sulfate forming metal with sulfuric acid in aqueous solution to form chromium trioxide and solid precipitated metal sulfate, removing by filtration a substantial part of the precipitated metal sulfate, evaporating the remaining solution to recover crude chromium trioxide, heating the crude chromium trioxide to a temperature of about 195° to 220°C. to melt the trioxide, and filtering the molten chromium trioxide to remove the residual solid reaction products.

Production of lead- and boron-free glazes. WILHELM DIETHER (vested in the Alien Property Custodian). U. S. 2,335,395, Nov. 30, 1943 (Jan. 23, 1941).—An improved ceramic glaze, free from compounds of lead and boron and having a firing temperature below 1100°C., which comprises 3.6 to 5 mol. of silica, an amount of barium oxide not in excess of 0.10 mol., and 0.4 to 0.8 mol. of potassium oxide, the glaze being substantially free from oxides of sodium.

Production of titanium dioxide. A. T. MCCORD AND H. F. SAUNDERS (Sherwin-Williams Co.). U. S. 2,333,660, Nov. 9, 1943 (Sept. 13, 1940).

Recovering lithium from minerals. A. R. LINDBLAD, S. J. WALLDÉN, AND K. A. SIVANDER (Bolidens Gruvaktiebolag). U. S. 2,331,838, Oct. 12, 1943 (June 20, 1939).

Separating and recovering potassium chloride and borax. E. P. PEARSON (American Potash & Chemical Corp.). U. S. 2,333,334, Nov. 2, 1943 (Oct. 16, 1939).

Titanium material treatment. L. G. BOUSQUET AND M. J. BROOKS (General Chemical Co.). Can. 415,187, Sept. 14, 1943 (March 4, 1941; in U. S. March 29, 1940). G.M.H.

Titanium oxide production. J. L. KEATS AND H. M. STARK (Canadian Industries, Ltd.). Can. 415,166, Sept. 14, 1943 (July 5, 1940). G.M.H.

Titanium oxide production. C. M. OLSON (E. I. du Pont de Nemours & Co.). U. S. 2,331,496, Oct. 12, 1943 (July 18, 1939).

General

Air compressors: I, Selection and installation. C. W. GIBBS. *Pit & Quarry*, **36** [4] 71–74 (1943).—Highly important points in the selection of a compressor are (1) operating pressure and capacity, (2) type of duty, (3) type of drive, (4) control of the compressor, (5) power source, and (6) need for standby equipment. The machine should be installed in accordance with the manufacturer's suggestions. Plenty of room should be left around it for ease in properly maintaining it. The ventilation of the room is important. For larger units, the air intake should be out of doors, from as cool a spot as possible, and 10 ft. above ground. The piping system should be as simple and direct as possible, and pipe sizes should be conservative. Certain accessories will aid successful operation, and preventive maintenance will also help. See "Adding. . .," *Ceram. Abs.*, **22** [1] 14 (1943). M.R.

Belt transmission chart. W. F. SCHAPHORST. *Chem. Industries*, **53** [3] 374 (1943).—This chart gives the relation between width of belt, revolutions per minute of pulley, diameter of pulley, thickness of belt, and horsepower. A light double belt will transmit about 33⅓% more power than a single belt. A double belt will transmit 59% more than a single belt, a triple belt will transmit about twice as much, and a 4-ply belt about 2½ times as much.

E.D.M.

Bethlehem Steel Co. studies performance of wire rope at Bridgeport quarry. ANON. *Pit & Quarry*, **33** [6] 61–62 (1940).—At its crushed stone plant at Bridgeport, Pa., the Bethlehem Steel Co. made an interesting study of wire-rope performance. On one shovel (3½ yds.), it uses a rope 12 ft. longer than necessary; this permits two shortenings and materially lengthens the life of the rope.

Carelessness of operators will shorten the life of a rope, while lubrication and semiannual cleaning of the rope will make it last longer. M.R.

***Boiler plant characteristics and coefficients.** H. KEDENBURG. *Wärme*, **65** [15] 131–34 (1942).—The factors determining the performance of a boiler plant are not considered by themselves but are coordinated with the principal factors of the condenser, machine, and pump of the installation as a whole. Only in this way can correct figures for the efficiency of the individual parts be obtained and a defect be ascribed to the part which actually causes it. Formulas for the evaluation of the factors are given. M.HA.

Ceramics, refractories, and cements. H. W. WEBB. *Ann. Repts. Soc. Chem. Ind. on Progress of Applied Chem.*, **27**, 193–204 (1942).—This literature review gives many references on new materials, mixtures, and processes. Enamels and refractories are covered thoroughly. R.C.PURDY

Color of machine parts improves workers' production. HARROLD BRAYMAN. *Ind. Finishing*, **19** [4] 74 (1943).—Lighting efficiency can be increased more than 100% without any change in fixtures merely by painting ceilings, walls, floors, and equipment with light-colored paints. C.W.

Control and collection of industrial dusts: IV, Cloth collectors. E. D. POWERS. *Rock Products*, **46** [3] 66–68 (1943).—Cloth filters are generally used when a high collection efficiency is required for a fine, dry, nontacky dust which is to be recovered in a dry state. They are more expensive than cyclones but less expensive than electrostatic precipitators, being competitive with wet scrubbers. **V, Baffle-type collectors.** *Ibid.*, [6] 70–72.—Wet or sticky dusts prevent successful operation of baffle-type collectors; their efficiency lies between the low-efficiency cyclones and the cloth filters and high-efficiency cyclone. They can be applied ideally where the collector can be operated off the draft of a stack already in place and where the dust particles are of such a size that the collection efficiency will be high or a medium high collection efficiency is satisfactory. For Part **III** see *Ceram. Abs.*, **22** [3] 64 (1943). B.C.R.

Description of the occupation of ceramic engineer. LEONARD CARMICHAEL. *Bull. Amer. Ceram. Soc.*, **22** [12] 412–13 (1943).

Dust reduction at the coal face by means of water sprays. C. G. WARNER. *Jour. Ind. Hyg. & Toxicol.*, **25** [7] 303–305 (Sept., 1943).—A recent inquiry into chronic pulmonary disease in South Wales miners involved experiments showing that the concentration of air-borne dust at the coal face can be reduced more than one-half by spraying all hewn material with water before it is further handled. The apparatus required is simple and the quantity of water used is small. No appreciable difference in the workplace humidity was found. As the roof was not sprayed, it was not adversely affected. Little extra work was imposed on the colliers. Accordingly, the consumption of water from the beginning of the experiments was not inconvenient to the management or to the colliers. See "Measurements. . .," *Ceram. Abs.*, **22** [5] 92 (1943). K.R.

Getting longer life from brake and clutch linings: I, Correct adjustment and maintenance. S. JONES. *Pit & Quarry*, **36** [4] 67–68, 76 (1943).—Most brakes and clutches are suitably designed for their specific duties, yet many bands, blocks, disks, and cones wear out, burn out, or glaze prematurely with resulting injury to metal wearing surfaces. Six causes of lining failure are (1) incorrect adjustment, (2) unskilled operation, (3) careless maintenance, (4) incompetent repairing, (5) faulty selection, and (6) improper application. M.R.

Hazards of exposure to glass wool, glass frit, or foam glass. ANON. *Jour. Amer. Med. Assn.* (Queries and Minor Notes), **122** [1] 69 (May 1, 1943).—In reply to an inquiry on hazards to the health of workers employed in making glass floss, the following answer was given: The term "glass floss" is variously applied to glass wool, to foam glass, and to the glass frit used in porcelain enamels. The manufacture of glass frit entails greater exposures, as common frits may contain lead, silica, fluorspar, cryolite, nitrates, antimony, etc. Colored frits may contain selenium, cadmium, chromates, uranium, or manganese, depending on the color desired. Some of these enamel frits have long been regarded as a frequent source of lead poisoning. It seems more likely, however, that this inquiry refers to glass wool or fiber glass, whose processes of manufacture are described in detail. Health-impairment factors, such as the very high temperatures required in remelting the glass or mechanical injuries to the skin from spicules of glass penetrating it, are referred to, but no specific pneumoconiosis is likely to arise. K.R.

Health hazards created by sand conditioning in foundries. ANON. *Illinois Labor Bull.*, **3**, 20–21 (April, 1943); abstracted in *Jour. Ind. Hyg. & Toxicol.*, **25**, 162 (Sept., 1943).—Industrial dust is a serious hazard to the health of war workers, and the evidence indicates that sand-conditioning operations are a source of this hazard. The causes are listed as (1) original inadequate control, (2) faulty operation of adequate control equipment, and (3) inadequate control due to the new heavy load imposed by war conditions. Hazardous dust conditions are measured by dust counts and silica counts per unit volume of air. The conditions observed and the procedures and equipment for eliminating them are discussed. K.R.

How color helps output of active machine tools. MALT DENNING. *Ind. Finishing*, **18** [6] 12 (1942).—Color and light in the right combination are required for strainless full vision. Tests show that buff for the working area and medium gray for the body of the machine is the best color combination. Light-colored paint for the walls, with white for the ceilings, was also found to be advantageous. C.W.

How to design exhaust hoods: I, Theory of flow into an opening. J. M. DALLAVALLE. *Heating & Ventilating*, **40** [3] 40–42 (1943).—The value of local exhaust ventilation in the control of occupational diseases caused by dusts, fumes, vapors, and gases depends on the design of suitable hoods or collectors placed near the hazard. The author discusses the fundamental principles of exhaust-hood design, involving changes in air velocities in openings under suction, change of velocity with distance outward along the axis of the hood, representation of velocity contours and stream lines, and similarity of velocity contours. Diagrams. **II, Velocity characteristics of common types of unobstructed openings experimentally determined.** *Ibid.*, [4] 44–52.—Contours, except for simple openings reducible to two dimensions, are impossible to determine by mathematical procedures. Hood velocities may be easily determined from scale models; sensitive instruments are required, and a modified Pitot tube is described which may be used with scale models. Velocity characteristics of common openings are discussed, as well as the relation between the opening area and velocity gradient, axial velocities, simplification of the center-line equation for flanged openings, generalization of center-line velocity equations, relation between size of hoods and connecting ducts, and determination of the velocity contours for compound hoods. There are many diagrams and five tables, the last of which gives a list of materials together with the air speeds in ducts necessary to carry them. **III, Velocity contours of hoods with special boundary conditions.** *Ibid.*, [5] 83–86.—By means of four types of hoods with some form of obstruction, sufficient information was obtained to permit the development of contours for any shape of hood under similar conditions. The method of estimating contours and the velocity contours of shaped openings and for narrow slots are discussed, and a formula for tank-hood air flow is given. See "Control . . . ," *Ceram. Abs.*, **21** [6] 133 (1942). M.R.

How to insure satisfactory service from your V-belt and flat belt drives. J. R. HOPKINS. *Nat. Engr.*, **47** [9] 566–68 (1943).—If properly designed and installed, belt drives could be forgotten. The advantages of automatic belt tighteners are that they lengthen the life of the belt and increase the efficiency of the drive. Pulley sizes are

* Obtained from microfilm.

as important as belt sizes. Two more strands of V belt should be installed than data sheets specify. Tabular data show (1) correct pulley sizes for belts, (2) correct pulley sizes for different sizes and speeds of motors, and (3) recommended belt speeds (in ft. per min.) for different pulley sizes and r.p.m. See "Keeping. . .," *Ceram. Abs.*, **21** [11] 240 (1942). M.R.

Industrial water-conditioning processes: I. W. W. CERNA. *Jour. Chem. Education*, **20** [3] 107–15 (1943).—The methods of conditioning water by sterilization, distillation, sedimentation, precipitation, filtration, softening, and aeration are reviewed briefly together with the essential chemical reactions. S.Z.

Keeping dust under control. J. M. KANE. *Metal Finishing*, **41** [9] 556–59 (1943); *Nat. Safety News*, **47** [1] 18–19, 88–90 (1943).—K. stresses the importance of routine checks to make sure exhaust systems function properly. Periodic hood-suction readings provide an accurate check on the performance of an exhaust system if they are compared with previous readings taken when the system was known to be fulfilling its function. H.K.R. & M.R.

Liquid dustproofs cement floors. ANON. *Ind. Finishing*, **19** [4] 88 (1943).—A new liquid, Evercrete, permanently dustproofs cement and also makes it waterproof and crumbleproof. C.W.

Lubrication of equipment: V, Screens. J. I. CLOWER. *Pit & Quarry*, **33** [4] 39–41, 43 (1940).—Two general types of screens, (1) revolving or rotary and (2) vibrating or shaking, are discussed, and their mechanism, lubrication problems, and lubricants required are considered. **VI, Pumps.** *Ibid.*, **33** [12] 35–38 (1941).—The lubrication of centrifugal, rotary, and reciprocating pumps is discussed. Correct lubrication involves the use of the proper lubricant as well as the correct application in the quality demanded by the unit. Included in the discussion are fittings and methods of lubrication. Diagrams. **VII, Ball and roller bearings.** *Ibid.*, **34** [6] 50–53 (1941).—C. discusses various types of ball and roller bearings and oiling devices; two tables give data for selecting oils and greases. M.R.

Maintenance of high pressure boilers. F. D. MOSHER. *Heating & Ventilating*, **39** [9] 30–32 (1942).—The importance of properly maintaining heating and process steam facilities cannot be overstressed. Maintenance should be started as soon as the equipment is taken out of service. Each unit so released should be immediately inspected, cleaned, and repaired. To be effective, the work should be done consistently and systematically. The responsibility for the completion of the job should be fixed. There is a discussion of factors entering into boiler maintenance such as soot, scale, piping, auxiliaries, and idle boilers. Photographs. M.R.

Make wire rope ends safe. C. R. HOCHMUTH. *Safety Eng.*, **86** [3] 27 (1943).—Solder is cast on some wire-rope ends to promote safety and to provide facility in handling. A non-preformed rope requires a soft-wire seizing to prevent raveling. M.R.

Motor economies. ANON. *Elec. Rev.*, **133** [3430] 234 (1943).—To economize in the use of critical metals, it is recommended that smaller margins be used in choosing machines to fit loads. Less liberal margins will provide motors with capacities nearly equal to the specified load, and wherever possible the use of ventilated rather than totally enclosed machines and squirrel-cage instead of low-speed machines will save copper and permit smaller frame sizes. M.R.

Motors do a better job. KEITH HENNEY. *Sci. Amer.*, **169**, 166–68 (1943).—Direct-current motors can now be run from a.-c. power lines by the use of the Thyratron tube rectifiers. These differ from ordinary rectifiers in having a grid; the control of the voltage on the grid allows control of the current through the motor from zero to its maximum possible value. Motor speed may be changed at any time while the motor is running, or it may be preset and controlled by a button. The electronic circuit automatically keeps the motor speed constant regardless of load. It may be used on motors of 1 h.p. or smaller for glass-drawing machines, cement conveyers, machine tools, and ceramic lathe drives. W.D.F.

New bonding method for metal and other materials. ANON. *Machinery* [N. Y.], **50** [1] 171 (1943).—A method of bonding metal to metal or rubber, plastics, leather, or wood to metal or to each other with a bond, in most cases stronger than the materials themselves, has been developed by the U. S. Stoneware Co., Akron, Ohio. The Reanite bonding process develops a metal-to-metal bond which is stronger than riveted or spot-welded joints. Reanite joints are unaffected by fresh or salt water and possess good corrosion resistance. The process is being used for airplane subassemblies, motor mounts, etc. R.H.B.

New eye-protection glass for welders. ANON. *Machinery* [N. Y.], **49** [12] 241 (1943).—The development of a new glass, Didymium Noviweld, which protects the eyes of gas welders and yet enables them to see welding operations from beginning to end has been announced by the American Optical Co., Southbridge, Mass. R.H.B.

New standard recommends limit on arsenic fumes in workplaces. ANON. *Ind. Standardization*, **14** [9] 247 (1943).—A new war standard recommends a maximum allowable concentration of metallic arsenic and arsenic trioxide of 1.5 mg. As per 10 cu. m. of air. Metallic arsenic is used in metallurgy, and arsenic trioxide is used in insecticides, glass, and for other purposes. W.D.F.

Nondusting variety of cement. ANON. *Pit & Quarry*, **33** [7] 53 (1941).—U. S. Patent 2,221,175 covers a nondusting cement in the form of tiny pellets or granules which readily disintegrate into cement particles when added to water used in mixing. The cement particles are conglomerated into small pellets by blowing finely ground cement upward in a shot tower. From the top of this tower, small globules of soap or resin are sprayed. The cement particles stick to the globules and when dry become free-flowing, nondusting pellets. A bond of resin or soap readily disintegrates when the cement is mixed with water. M.R.

Overhead monorail or trolley conveyers. W. H. ATHERTON. *Mech. Handling*, **30** [8] 330–40 (1943).—A. discusses overhead conveyers used in a number of industries including an "unusual" installation in a glazed-tile works at Hereford, England. This conveyer carries saggers containing fancy tile to and from firing kilns. The monorail is 877 ft. long and the load per carrier is 50 lb. It is a complex system with 11 horizontal turns and 20 vertical bends. The chain speed is 37 ft. per min., and the main sprocket wheel is 40 in. in diameter and has a 5-h.p. motor drive. Photos and diagrams. M.R.

Owens-Corning Fiberglas Corp. completes new laboratory center. ANON. *Bull. Amer. Ceram. Soc.*, **22** [12] 415 (1943).

Pennsylvania Salt Mfg. Co. acquires Stotesbury house for scientific laboratory. ANON. *Bull. Amer. Ceram. Soc.*, **22** [12] 415 (1943).

Permanent samples exhibit aids New York City's Department of Public Works. ANON. *Eng. News-Record*, **131** [10] 362–63 (1943).—A permanent exhibit of construction materials is described in which most of the basic materials have been incorporated into the design of the floors, walls, partitions, etc. One panel represents a cross section of a face-brick wall, backed up and bonded to hollow tile and set horizontally; the channels in the tile act as drainage ducts. Another panel illustrates the cavity type of brick-wall construction, which has a 2-in. air space and moisture escape provided by flashing and weep holes. Permanent cabinets hold about 200 samples in a variety of colors and textures made from shale and refractory clays. Illustrated. G.A.K.

Pioneer highway tunnels modernized for service. ANON. *Eng. News-Record*, **131** [9] 326–29 (1943).—The twin 5889-ft. long Liberty Tunnels at Pittsburgh have been modernized by a new drainage system, new roadway slabs, a 9-ft. high glazed-tile lining along both sides of each tube, new lighting, improved approaches, and new carbon monoxide recorders. The tile lining was built of 8 x 16-in. vitreous glazed tile of low absorptive properties. To tie the tile to the concrete lining, special adjustable, noncor-

rosive anchors were designed and spaced on 5-ft. centers horizontally and 4 ft. vertically. The tile wall was built in 30-ft. long sections and a 1/4-in. premolded cork filler of a color to match the mortar between the tile was inserted in the vertical joints. In every fourth longitudinal joint, a 1/4-in. diameter pencil reinforcing rod was installed to which the anchors were attached. Illustrated. G.A.K.

Planned power-transmission system. E. R. RATH. *Pit & Quarry*, **34** [9] 70–71 (1942).—The results of a study are given in which transmission manufacturers, salesmen, mill supply houses, power users, consulting engineers, and others were interviewed. The two general types of power transmission in industry are individual drives and modern group drives, and both types are used in planned power transmission. The planning involves the collection of data; study of production methods, machine characteristics, plant layout, and machine location; time study; material handling; and selection of the proper drive for the job. A discussion is presented of many machine elements entering into power transmission. M.R.

Postwar planning. ANON. *Bull. Amer. Ceram. Soc.*, *22* [12] 416 (1943).

Preventing rust on iron and steel. JOSEPH TOKARZ. *Ind. Finishing*, **18** [3] 76 (1942).—A new coating, Stop Rust Coating, combines a rust-inhibitive chemical and a tough waterproof coating. It dries quickly and enables the articles coated to be handled an indefinite number of times. C.W.

Prolongation of glass patents. S. T. MADELEY. *Glass*, **20** [9] 233 (1943).—The English patent law permits patentees to obtain extensions of term (maximum of 10 yr.) of their patents on the sole ground of loss or damage due to the war. At most an extension will be made equal to the period between the beginning of the war and the date of expiration of the patent; the patentee may make further and later application when the amount of damage can be more accurately ascertained. B.C.R.

Queens Midtown Tunnel. O. SINGSTAD. *Proc. Amer. Soc. Civil Engrs.*, **69** [3] 361–97 (1943).—The engineering features of the Queens Midtown Tunnel, its planning, design, and construction are discussed. Geologic data obtained from test borings showed the rock floor to consist of Manhattan schist and to change progressively to Inwood limestone, Fordham gneiss, Hell Gate dolomite, and Brooklyn injection gneiss. Brief mention is made of the design of structures, including (1) lining for shield-driven river tunnels, (2) midriver sump and pump chamber, (3) rock tunnels and steel-bent and concrete structure, Manhattan, (4) steel-bent and concrete structure, Queens, (5) tunnel interior, (6) plazas and approaches, Manhattan, (7) plazas and approaches, Queens, (8) plazas and approaches, architectural finish, and (9) buildings. The walls of the tunnel are finished with ivory-tinted, ceramic, vitreous, semimat glazed tile with a diffused light reflection factor of 0.78. At the ceiling is a continuous border of Ming green tile; the ceiling is finished with 6- by 6-in. light ivory-tinted pebbled glass tile. The tunnel sidewalk bench is faced with light, bufftone, mottled glazed, architectural terra cotta. A sidewalk railing is composed of cream-colored porcelain enameled steel pipe. Tunnel ventilation, tunnel lighting, tunnel operation, and construction are also discussed. Numerous diagrams. Extended research is no longer necessary in planning and designing tunnels. M.R.

Resistance of concrete increased by new development. ANON. *Machinery* [N. Y.], **50** [1] 170 (1943).—A new product that makes concrete several times more resistant to weather and abrasion in dams, fortifications, and construction projects has been developed by the United States Rubber Co. The product, Hydron, is an absorptive lining for forms in which concrete is poured. The linings consist of an absorptive material faced with a fabric. They are easily applied to the concrete forms by stapling. By removing water and air bubbles from the surface of the concrete, Hydron aids in producing a concrete that will last longer and will have a smoother and more pleasing finish without brushing or scraping. R.H.B.

Secondary functions of power-transmission guards. E. L. CADY. *Mill & Factory*, **32** [6] 83–85 (1943).—Ordinarily in designing guards for power-transmission units the only thought is for the safety of the human factor. Several practical hints are given that will make these guards serve a multiple purpose. Guards are required by insurance companies, state laws, and safety engineers; if they can be made to serve a dual purpose, the dividends received from their installation are increased. Several examples are given to show how they can be used (1) to protect belts from oil and waste material if oil-resistant fiberboard is used instead of open-wire screens, (2) tool storage, (3) temperature control, (4) material evacuation control, (5) shaft alignment, and (6) dust-control aid in the lubrication system. Illustrated. A.G.B.

Sewer charts based on Scobey's formula. P. E. WHITTINGTON. *Eng. News-Record*, **131** [15] 548–50 (1943).—W. presents three charts that permit rapid graphical solution of sewer design problems by use of the Scobey formula. Selection of the proper coefficient of friction determines the chart to be used. Once this choice is made, but two of the four variables, i.e., slope, capacity, velocity, and diameter, need be known to solve the problem. G.A.K.

William Cameron Sproul. ANON. *Bull. Amer. Ceram. Soc.*, **22** [11] 361–66 (1943).

Tipping worn high-speed steel tools with cemented carbide. CARL BLADE. *Machinery* [N. Y.], **50** [3] 198–200 (1943).—About a year ago the Yale and Towne Mfg. Co., Stamford, Conn., began salvaging high-speed tools by renewing their cutting surfaces with cemented-carbide tips, applied by means of torch brazing. This practice proved so successful that the company is now applying cemented-carbide tips to new high-speed steel tools, thus increasing their life expectancy many times. The circular form tools and the high-speed steel form cutters are typical implements which are adaptable to the reclaiming technique. R.H.B.

University of Illinois. ANON. *Bull. Amer. Ceram. Soc.*, *22* [12] 414–15 (1943).

Use of the microscope in particle-size analysis. G. LOWRIE FAIRS. *Chem. & Ind.*, **62** [40] 374–78 (1943).—For coarse powders, a sieve analysis is probably the simplest and best method of obtaining the weight distribution, but it is applicable only to cases in which the majority of the particles are greater than 50 microns in diameter. For powders largely in the subsieve range, the microscope has been widely used, but until recently there has been no real check on the accuracy of this method. The object of this research was to develop a technique by which the microscope may be relied on to give accurate and reproducible size analyses. The main inaccuracies encountered are (1) uneven dispersion of the sample on the slide, (2) sizing of an insufficient number of particles, and (3) inaccurate estimation of the size of nonspherical particles from their projected areas. The first two sources of error are obvious, but all methods of size analysis involving the measurement of free-falling speeds express the particle diameter in terms of the "equivalent sphere." The microscope, however, measures a projected area which, in the case of nonspherical particles, must always be related to the two major axes, and it has been found, when using an ordinary linear scale graticule for size estimation, that the particle diameters obtained thereby are in general greater than those calculated from the corresponding free-falling speeds. This necessitates the use of a "shape factor" to correlate them with Stokes' diameter. By using graticules consisting of a central rectangle subdivided into small rectangles and bounded by or containing a series of graduated circles, it is possible to estimate this shape factor for ground powders in the subsieve range and also to obtain simultaneously a particle count and size distribution. In addition, by a special technique of sampling and preparing the powder dispersions for examination, accurate results can be obtained. The method requires 3 to 4 hr. R.H.B.

Wage and hour responsibilities of nonmetallic-mineral producers. ANON. *Pit & Quarry*, **36** [4] 63–64, 66 (1943).—Cement, gypsum, lime, stone, clay, and glass products

have acquired new significance. The present war emergency has greatly increased their use as substitutes for less plentiful materials. The postwar period will probably see a continuation of this demand, especially in meeting the need for new homes. Housing will depend on purchasing power which is closely tied up with labor standards. The nonmetallic-mineral industries are interested in the Fair Labor Standards Act of 1938 ("Wage and Hour Law") and the Walsh-Healey Public Contracts Act. About 20,000 out of 500,000 wage earners now in these industries are receiving less than 40¢ per hr. U. S. labor statistics show that in February, 1943, the average hourly wages in stone, clay, and glass products industries were 82.2¢ and in quarrying and nonmetallic mining 74.9¢. Under the Walsh-Healey Act, wage determinations have been made for cement, stone, clay, and glass products industries in cents per hr. min. wage as follows: south 32.5, northeast 57.5, and other states 42.5. Basic straight-time hours of work under this Act are 8 in any one day or 40 in any one week. Employers in areas where the 48-hr. week is mandatory are reminded that both the Wage and Hour Law and Walsh-Healey Act provisions still apply. The administrator has found the sand and gravel, crushed stone, and brick-manufacturing branches of the nonmetallic-mineral industries to be of a "seasonal nature." M.R.

Westinghouse Electric & Mfg. Co. plans quick conversion to peace production. ANON. *Bull. Amer. Ceram. Soc.*, **22** [12] 416–17 (1943).

Women's place in the foundry industry. SARA SOUTHALL. *Amer. Foundryman*, **5** [11] 6–9 (1943).—Women are being accepted in the foundry industry in increasing numbers. Jobs taken over by them include timekeepers, checkers, core-makers, machine operators, temperature control operators, and laboratory technicians in physical, chemical, and sand-testing laboratories. M.A.S.

SEPARATE PUBLICATIONS

Ceramic Data Book. Industrial Publications, Inc., Chicago, 1943. 16th ed. 292 pp. Price $1.00, free to subscribers of *Ceramic Industry* and *Brick & Clay Record*.—The coverage of ceramic material, equipment suppliers, and ceramic data is more complete than ever. Necessary data have been brought up to date, and important new information has been added. Maintenance of equipment is a new section devoted to the care of machinery in the plant. The care of shovels, screens, engines, tires, and many other items is included. A buyers' guide comprises a complete listing of ceramic machinery, equipment, and materials and where to buy them. The names of many new manufacturers and suppliers have been added, and a simplified cross index quickly identifies the products. The new edition includes 140 pages of advertising. As these pages follow the buyers' guide, they are easily accessible for checking the details of machinery or equipment listed in the guide. As in former years, the ceramic data section of the book is a complete and comprehensive compilation of charts, tables, and details on manufacturing and scientific processes. Conversion tables, heat data, construction data, and methods of calculation are available for the scientist and laboratory man. The data section of the book covers not only general information common to all phases of ceramics but specialized data as well for each section. Glass, enamel, whiteware, refractory, and structural sections are individually classified to give more pertinent information to the executive, plant, or laboratory man.

Chemical Engineering Catalog, 1943–44. Reinhold Publishing Corp., New York, 1943. 28th ed. 1514 pp.—This book is a collection of condensed and standardized data on equipment, machinery, laboratory supplies, chemicals, and raw materials employed in chemical processes. It includes classified indices carefully cross-referenced. It also has a complete list of important books in English on chemical and related subjects. It was compiled by a joint Chemical Engineering Catalog Committee of the American Institute of Chemical Engineers, the American Chemical Society, the Society of Chemical Industry, and the Salesmen's Association of the American Chemical Industry.

Study of Decay of Mine Timber: II. JAMES N. SCUDDER, HENRY E. DEKAY, JR., AND ALBERT L. TOENGES. *U. S. Bur. Mines Rept. Investigations*, No. 3710, 14 pp. Free.—The report gives the results of a study to determine the decaying effect of rock dusting upon mine timbers. A comparison is made of the extent of decay of timbers in two mines in which underground conditions were similar and shows the loss in strength of the timbers after exposure to mine atmosphere. R.A.H.

PATENTS

Colored glazed coated granules and roofing sheet material surfaced therewith. G. W. SWENSON (Minnesota Mining & Mfg. Co.). U. S. 2,331,358, Oct. 12, 1943 (July 23, 1941). U. S. 2,331,868, Oct. 12, 1943 (May 15, 1941).

Colored surface coated glazed granules, useful as roofing granules, and process of making. G. W. SWENSON (Minnesota Mining & Mfg. Co.). U. S. 2,331,356, Oct. 12, 1943 (Dec. 19, 1932).—In the process of producing colored granular material by affixing to a base granule a stable, substantially permanent color-bearing inorganic bond, the steps which include homogenizing glaze-forming materials and a color-bearing material upon the surfaces of the base granule by intergranular contact of the base granules during the mixing under heat-treatment in the presence of an adhesive vehicle of a low-melting material to form a smooth paste of plastic character tenaciously adhering to the base granule, continuing the mixing to provide a uniform coating of the homogenized paste, and then continuing the heating and mixing to fuse the glaze materials upon the base granule.

Treating mineral substances and product. G. W. SWENSON (Minnesota Mining & Mfg. Co.). U. S. 2,331,357, Oct. 12, 1943 (March 28, 1934).

THE BULLETIN SECTION

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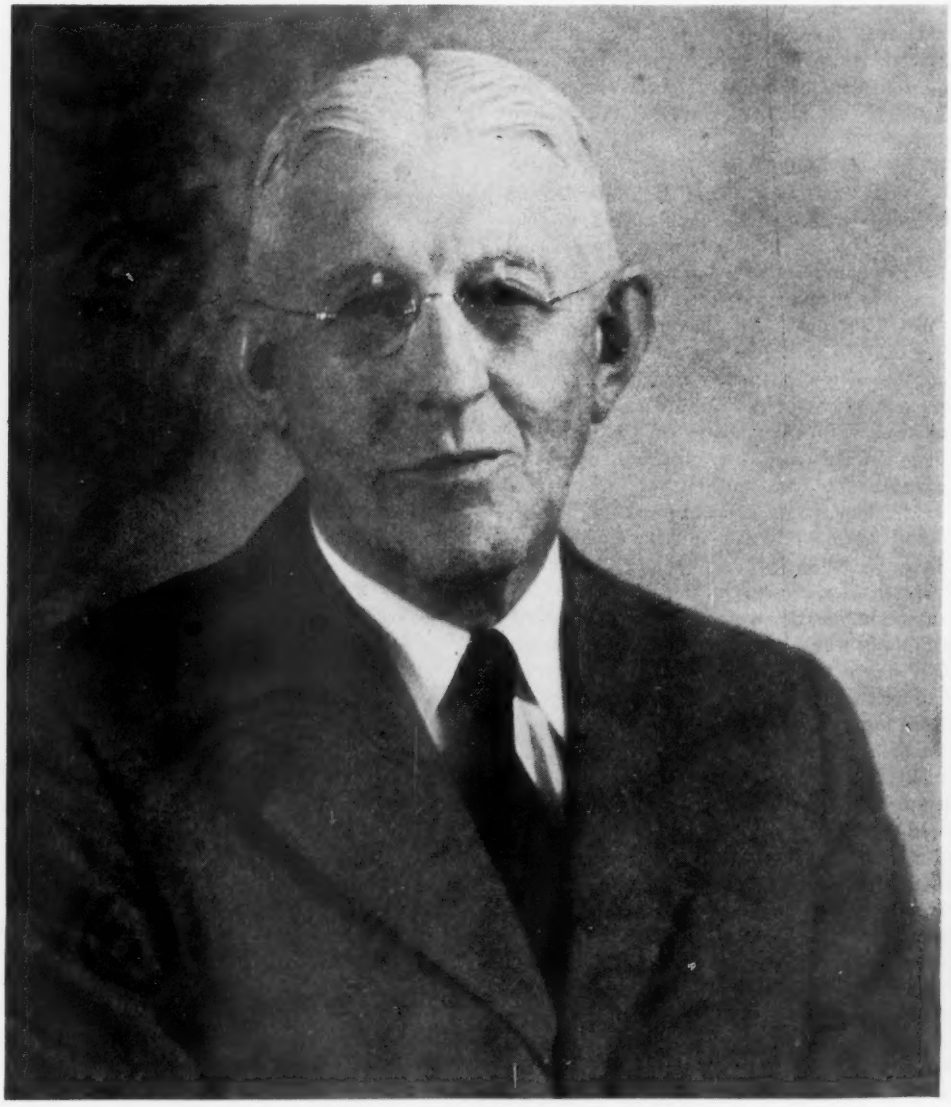


GEORGE ESTES BARTON

GEORGE ESTES BARTON

By James G. Vail

In the later decades of human experience it is a common error to wish for youth and to forget how difficult life would be without the accumulated values which the years have brought. Moses on Mount Pisgah had a vision of a land which was possible only because he could look back on the long trail which led him to the point of vantage, because he could remember the struggles in the wilderness and was able to understand what a good life would be. This is not a sermon—rather it is an appreciation of a fruitful life that gives to our friend, George Estes Barton, a degree of wisdom which is the product of years of consistent, often inconspicuous, industry. One cannot say that he is old, but he has qualities rarely, if ever, found among the young.

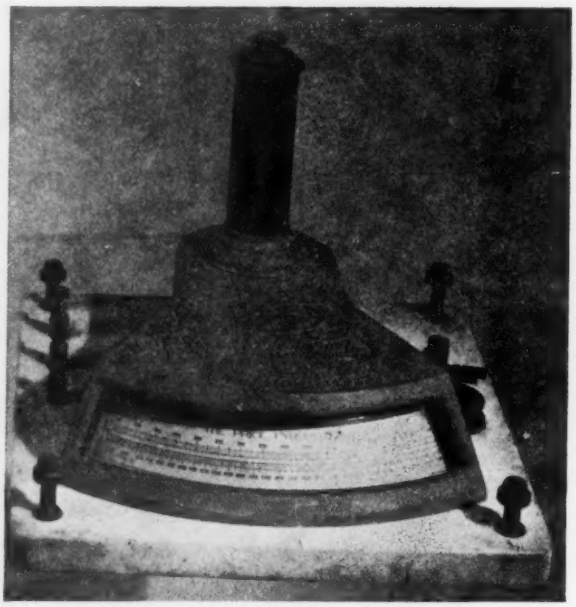
In the "American Contemporaries" series,[1] the present writer offered a character study of George Barton, with some reference to heredity, education, and family life. At that time, circumstances did not permit a more than casual reference to his most important technical work, namely, the study of manufacturing processes for glass and the improvement of the product. All the study of organic plastics has not bridged the great disparity between the cost of glass and that of vitreous materials whose structure is arranged around atoms of carbon instead of silicon. With our industrial future committed to the extensive use of glass, it is thus of more than ordinary interest to consider George Barton's contribution.

A series of meticulous notebooks on glass begins under the date of March 20, 1896, when he went to Millville, New Jersey, because the making of picric acid was a less satisfying prospect than a part in the pharmaceutical industry, with its implications of healing. He applied first to E. R. Squibb, who had no opening, and by reference from them joined the Whitall-Tatum Company, for whom and their successor, the Armstrong Cork Company, he has worked for more than forty-seven years.

One of his earliest pieces of work was the perfection of a method of etching a guarantee mark on druggists' glass graduates by applying the hydrofluoric acid mixture to the glass surface with a rubber stamp. It sounds easy and has been repeated millions of times, but there were details to work out and no one else had thought of it until then. The same year he engaged in a study of the actual volume of glass containers and the means of producing burettes, flasks, and pipettes for chemical laboratory use, as well as druggists' graduated ware of consistent and precisely indicated capacity or delivery. It is interesting to note that the graduated ware which George Barton then developed is still being made and that the standards are nine steps removed from the international kilogram, which we hope is still kept at St. Cloud, just outside Paris.

A paper read by him at the Boston Meeting of the American Chemical Society in August, 1898, entitled "Volumetric Apparatus," presents the type of work for which we now so readily turn to the National Bureau of Standards. There was then a Bureau of Weights and Measures in Germany, and papers on metric standards had been presented to International Congresses of Applied Chemistry in Brussels, Paris, and Vienna; but it was this line of thought which led to the founding of the National Bureau of Standards as we know it now.

George Barton's interest in basic data and a sound literature led him to enormous labors for *Chemical Abstracts*, in which he served as assistant editor from its beginning in 1907. He was associate editor of the *Journal of Industrial & Engineering Chemistry* from its founding in 1909 until 1917.



The imported pyrometer (Kaiser & Schmidt, Berlin)

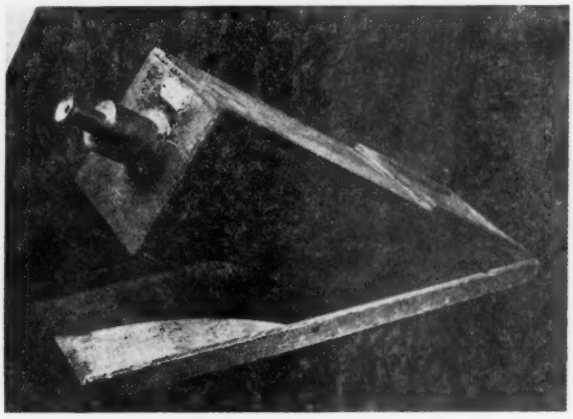
To return specifically to glass and our chronology, it was in 1898 that he observed a difference in the chemical behavior of the inside and outside surfaces of glassware. The knowledge of that time did not permit an adequate explanation, if indeed one is available now, but that did not prevent the empirical development of different solutions for the controlled etching of the unlike surfaces of identical composition. Glass pestles for pharmaceutical mortars could not be satisfactorily treated with the "outside mixture" of hydrofluoric acid and ammonium fluoride until after annealing.

Glassmaking is an ancient art which at the beginning of this century in this country had been but slightly influenced by the innovations suggested by science, though the products of collaboration between science and art in the hands of Otto Schott at Jena were beginning to be

[1] *Ind. Eng. Chem. News Ed.*, **14** [9] 183 (May 10, 1936). Published by the American Chemical Society. Excerpts from this article are given on p. 4, this issue.

known. In 1899, we find George Barton importing a German pyrometer before anything suitable was made here and starting to measure furnace temperatures in a bottle plant. The couple was platinum, platinum-iridium. Rhodium had not then been introduced for thermocouples. The human eye was expert, but many a new economy came with the recording and control of thermal sequences. During George Barton's time of service in the industry, the labor costs in bottle manufacture were reduced from seventy-five to fifteen per cent, which is an index of the progress he not only witnessed but to which he contributed substantially.

George Barton is believed to have worked out and put on the market the first borosilicate glasses made in this country. His paper read at the Pittsburgh meeting of the American Chemical Society in July, 1902, stressed the low solubility rather than the coefficient of expansion, though this had a value of about 60 as compared to 90 to 115 for the bottle glass of that time and 40 for modern ware designed to resist thermal shock. Chemical laboratory ware and combustion tubing were for many years made from his compositions under the name of Nonsol. It was the only domestic chemical glassware at the time of the outbreak of the First World War, and was made on the following formula: Sand 100, 58% soda ash 18, nitrate of soda 6, antimony sulfide (needle antimony) 1, zinc oxide 13, china clay 9, borax 29, and magnesia 13%.



An early polariscope

Though strains in glass were detected with polarized light as a laboratory technique at an earlier date, George Barton was the first to use polariscopes as factory control instruments. The first polariscopes were crude, homemade affairs with stacks of the thinnest obtainable glass plates as the polarizing medium, and depending on direct sunlight as the light source, but they revealed the faults of manufacture and led to a prompt improvement of the product. They were first applied to glass-stoppered c.p. acid bottles in 1911. Later, better instruments were imported from Germany, and still later they became available here. Now they occupy such an essential place that we almost forget they had to have a beginning.

In 1914, the local sands of New Jersey were unsuitable for the better grades of glass. George Barton observed that the principal impurities in this nearby supply were ilmenite and rutile, which existed as separate grains in the deposit. The wet concentration of ores for the recovery of heavy values was well known, but it required a radical redesigning of the process and equipment, with the patient collaboration of the makers, to recover the tailings as the values and reject clearly and economically the fine-grained iron- and titanium-bearing minerals present in an amount of a few parts per thousand. The iron was thus reduced from about 0.1 to less than 0.025%, or within the decolorizing range. This process has been extensively used, and the once inferior sand is now available for colorless glass.

Living close to the manufacturing processes, one acquires knowledge almost impossible to gain by laboratory study. When 58% Solvay soda ash, almost pure sodium carbonate, became available for glassmaking, troubles were encountered in the formation of a silica scum on the surface of glass in tank furnaces. George Barton remembered that the Le Blanc soda ash (48%) had not produced this phenomenon. Analysis gave the answer, and the addition of small amounts of sodium sulfate with the purer ash removed the imperfection. Here again keen observation and logical experiment provided a practical result ahead of an understanding of the mechanism. As this improvement was not published at the time, it is impossible to prove whether George Barton was the first to discover it, but he worked it out and practiced it independently.

Another result of careful study combined with direct experience of operations was the practice introduced in 1928 of using small amounts of barium sulfate in tank glass to eliminate seedy glass. There was a time when 30% of seed-free glass was a not uncommon yield in the glass container industry. George Barton brought it up to 100%. With the improvement in quality came an increase of furnace capacity of from 50 to 100%, depending on the color of glass being made. The importance of this step was obviously great.

In 1938, there was a fresh and vigorous demand for bottle glass of low alkalinity which would at the same time be free from one of the most troublesome defects, called "weathering." George Barton had previously studied the problem; indeed, his notes show that a customer's complaint of weathering had been presented three days after his first employment. The solutions then available were outside the range of permissible cost. A more ample support of research in recent years led to success in producing both flint and amber bottles of this quality. It was not simply a matter of making a new and less alkaline composition, but there were limitations of cost, new methods of machine operation. The amber glass was the more difficult, as a new coloring composition had to be worked out and months of costly large-scale experiment were required. George Barton modestly says he does not claim the complete and final answer, but when pressed he admits that he does not expect further trouble with the old problems of alkalinity and weathering. The modern bottles produced according to his patent will stand 80% humidity at 100°F. for a year without visible effect.

There were many incidental studies along the way. A thorough examination of the design and operation of gas producers for glassmaking was undertaken. The reactions and temperatures were studied before there

were adequate publications to guide him, and the practice was materially improved by his findings.

The scientific spirit of our friend leads him to disclaim things for which he was not primarily responsible, but in such areas as machinery and management he has been a helpful collaborator. His care in pointing out the debt he owes to other members of the organization where he has worked so long is evidence of the fairness and natural modesty which is a deep and admirable element of his character. But this must not be allowed to obscure our view of his own steady creative contribution. Our industries, our country, the world may take the deepest satisfaction in such a pattern of service as is here reviewed. He brought science to a section of industry where craft had been the rule; he grew with it; and after nearly half a century his mind is still leading and exploring. A press agent could have dramatized his story, but it remained for friends to seek out the facts and record their appreciation.

The following are excerpts from Mr. Vail's article in the "American Contemporaries" series published in the News Edition of *Industrial and Engineering Chemistry*.

"There is a quiet little town on the Connecticut River, its main street the course of an Indian trail. From Hatfield, Massachusetts, one looks up to King Philip's seat and thinks back to the old chieftain keeping watch. There are great elm trees once measured by Oliver Wendell Holmes and memories of Jenny Lind who sang in their shade. This is the locus of boyhood and youth of him we now know as George Estes Barton. His father was a physician. Dr. Chester Manley Barton and his wife, Clara Whitman, came to Hatfield from Worthington, Massachusetts, when their son George was two years old. The blood of Puritan and Quaker lines combined with environment to reflect the culture, the earnestness, and the restraint of the best New England tradition. At public schools in Hatfield, then Smith Academy, and Deerfield Academy the atmosphere around work and play implied a high standard to be maintained. The good names of generations of ancestors in the churchyard stood for character, fidelity, and discipline. There are those who say such things count for little. In the present case the evidence is against them.

"At the age of twenty, we find him graduating from Worcester Polytechnic Institute, a Bachelor of Science with a reputation for thorough and persistent work in chemistry, his chosen field. The next year, 1891–1892, was spent as assistant chemist at the Naval Torpedo Station at Newport, Rhode Island, from whence he went to the Aetna Powder Company, Aetna, Indiana (1892–1894), and then to Washington as private assistant to Charles E. Munroe, world-famed explosives expert, until 1896. During this latter time, he earned his M.S. at George Washington University. Papers on the manufacture of dynamite, examination of glycerol for nitroglycerin manufacture, and arsenic in glycerol were the fruit of this period.

"One great debt we who practice chemistry owe to him. His insight, his public spirit, and more than these, his sustained and often unnoticed labor have done much to develop the services of the American Chemical Society to industry. He joined the Society in 1891, and it might, except for such as he, have developed wholly along academic lines!

"It was an American Chemical Society Committee on Graduated Chemical Glassware, of which he was a member, which became convinced of the need of a United States Bureau of Standards. The vision was something, but backed by much patient effort it became a reality. This is one of those things, evident enough after the accomplishment, which come only after enormous obstacles are vanquished. His satisfaction in the retrospect is quiet but deep.

"In his community of Millville, New Jersey, he has an enviable record of good citizenship. The local social and athletic association, an organization for young men, has had his active interest and his service as treasurer and member of the board for years. A long record on the school board made claims on his best energies for constructive leadership, and he has been director and president of the Public Library Corporation. If you talk to his neighbors you will find that they delight to come in for an evening of chess and the genial fellowship that goes with it. His inner sanctum at home, full of books, proclaims the inveterate reader that he is, and his conversation is enriched by a wide background of knowledge."

PRESIDENT'S EDITORIALS

LOCAL SECTIONS—THEIR OPPORTUNITY FOR SERVICE

By Cecil E. Bales

The future growth of The American Ceramic Society depends in a large measure upon the activities of its Local Sections and Student Branches. It is regrettable that the exigencies of war have just about eliminated Student Branches, and food and gasoline rationing have made it more difficult to conduct Local Section meetings. Many of our members are vigorously engaged in war activities of various kinds and they feel that they have neither the time nor the inclination to participate in Local Section activities.

This is not the proper spirit, and it is not being fair to yourself or to The Society. Regular Local Section meetings are needed more at this time than ever before. They afford relaxation and entertainment for the tired body and mind. They enable you to meet your fellow ceramic engineers and technologists on a friendly basis, to "talk shop," to exchange confidences, and to catch up with the latest "stories."

You may listen to technical papers presented by outstanding men in various branches of the ceramic industry. Many of them tell about war developments, whereas others discuss postwar problems. Not long ago, the Pittsburgh Local Section celebrated its Silver Anniversary, and it

was a grand and glorious occasion. Everyone had a fine time and enjoyed listening to Sidney D. Kirkpatrick, editor of *Chemical & Metallurgical Engineering*, tell about war developments of postwar usefulness.

Some Local Sections prefer social programs rather than too many discussions on technical subjects and they have enjoyable summer picnics and Christmas parties. Probably the most successful programs are those of a well-balanced nature—part social and part technical. Just recently, the Central Ohio Local Section had a very successful meeting. An interesting lecture was given by Roy W. Wampler, assistant director of research for the Libbey-Owens-Ford Glass Company, on recent developments in glass and this was followed by refreshments consisting of cider and doughnuts. The members "let their hair down" during the social period and everyone had a good time. The Baltimore-Washington Local Section conducts very pleasant meetings.

Many technical men are reticent by nature, appear to be timid, and do not like to speak in public, but when the "ice is broken," these same men are found to be "good fellows" and real friends. They were just waiting for someone to give them a smile, a hearty handshake, and a friendly word. To such men, the Local Section offers a real opportunity. There, they may learn to speak on their feet, they may learn the technique of organization, they have an opportunity of meeting personally many celebrities in technical fields, and above all, the fellowship developed in these meetings will prove to be of great future value.

Many of our members are unable to attend the Annual Meetings of The Society for one reason or another. These members should have the privilege of taking part in regularly scheduled Local Section meetings. It would stimulate their interest in The Society and the personal contacts would be of inestimable value to them. A substantial number of new members would join The Society if Local Section meetings were available to them.

I should, therefore, like to urge the officers of all our Local Sections to make a determined effort to hold at least six meetings a year. It can be done. I also ask all the members located in those territories where Local Sections now exist to affiliate with and take an active part in the activities of their Section. I also ask the chairman of Sections and Divisions of The Society to make a critical study of the geographical distribution of our membership and to establish any new Local Sections that may be needed.

A strong group of Local Sections is of vital importance to the future welfare of this Society and of its members. Will you do your part?

LET'S DOUBLE OUR MEMBERSHIP

By Cecil E. Bales

Over the past forty-five years, The American Ceramic Society has had a consistent, normal, healthy growth in its membership, but the surprising thing is that we do not have more members in this Society. It is the oldest and largest ceramic society in the world, and we get more for our money in the way of publications and service to industry than from our memberships in many other technical organizations.

Why is it that only about half the graduates from ceramic schools belong to The Society? Is it due to lack of interest, or is it due to the fact that the advantages of joining The Society are not pointed out to them by their professors while they are in school? This situation should be corrected and it will be.

This Society should have as members every corporation and every individual having any interest whatever in ceramic raw materials, equipment, and ceramic products. We especially need Corporation Members, not only because of their financial support, but because of the interest their executives would take in the affairs of The Society.

I feel that we should double the membership of our Society within the next two years; in fact, there is no reason why we could not have 10,000 members within a reasonable period of time.

One very fertile, yet practically unexplored field for new members is among the production men in ceramic plants. Every superintendent, every production manager, and all their assistants should be given an opportunity of joining The Society. All officials of every ceramic plant should be invited to join.

To interest the production men, it will be necessary to change somewhat the policy of our Divisional Program Committees. We must present and publish more papers on practical operating problems, papers that would be of real assistance to production men. Plans to bring this about are already under way.

Salesmen of ceramic products are good prospects for membership. They need the technical information The Society would supply to them through its publications.

The manufacture of Portland cement, lime, and gypsum products are all ceramic processes, and the technical and operating men in those industries need the services of this Society.

There are many prospective members right in your own vicinity. Tell them of the advantages of belonging to this great Society and of the service it renders to its members and to all branches of the ceramic industry. With an enlarged membership, The Society could be of even greater service to its members.

YOU AND TOMORROW AND CERAMICS *

By Hardy L. Winburn, President The Niloak Co., Little Rock, Ark.

All of us are thinking about the new day that is to break when peace comes back, and about our places in it. Especially are educators concerned about the effects of a system which proposes to remove many of the landmarks, putting in their places courses of study in which the subject matter is organized around practical rather than abstract objectives. One such course is ceramics. There are

* Reprinted from *Jour. Arkansas Education*, November, 1943.

indications that it may mean much to all of us, and like many such things, it can become a source of constructive educational effort in the hands of sincere and qualified people.

The study of ceramics is the study of the arts and sciences related to the silicate industries. This planet is about 80% silica, you may recall. The industry is usually divided into nine groups: Structural Clay Products, Cements, Glasses, Refractories, Whiteware, Abrasives, Enamels, Materials and Equipment, and Design (or Art). Arkansas has fine structural clay plants at Malvern, Perla, Fort Smith, Hope, and Jonesboro, manufacturing face brick, common brick, partition and load-bearing tile, and drain tile. Sanitary clay pipe, a closely allied product, is produced at Texarkana in a splendid plant. Portland cement is manufactured on a large scale at Ashdown, and there are two glass plants at Fort Smith. Refractory brick and shapes are produced in large and successful operations at Malvern and Perla. Of course there are many types of cements and glasses and Arkansas makes only a very few of them, as in the glass industry only window glass and lamp chimneys are made. Some greater diversity is evident in the refractory plants, but this field is also large and highly specialized and our plants make no effort to cover all of it. What is done is done well and the plants and products and men stand high in national technical circles.

Most people associate ceramics exclusively with art pottery and decorative tile. Arkansas has plants producing these at Camden and Benton. Dinnerware, kitchenware, and ovenware are also produced and there are plants at Benton and Hope producing good grades of stone farm supplies. Earthenware for flowerpots, acid ware, and decorative uses is also produced and, since the war, porcelain for electrical and technical use, as well as table use, has been developed. Also the metal shortages have resulted in the manufacture of a large and sometimes strange group of substitute items for the factory, the farm, the home, and the armed forces.

Abrasives, in another ceramic field, are not produced in Arkansas, but ore for the grains is mined at Bauxite. Enamels is one of the few phases of ceramics not practical here in any form. Ceramic equipment is produced to a limited extent and ceramic raw material to a considerable extent, mostly in the form of silica and clay.

Structural clay and stone pottery are past three quarters of a century in age and several of the other divisions are into their second generation.

Elementary teaching in ceramics is usually preceded by chemistry or general science and involves a study of simple bodies and glazes. An introduction to the phenomena of plasticity and vitrification is thus effected. Basic definitions and raw materials are made familiar and the general processes and equipment types are considered. An early separation between the art and the technology is attempted, devoting to the art every serious consideration appropriate to a proper appreciation of any form of art and approaching the scientific aspects of the technology in the attitude of eager but precise observation so essential to progress in these spheres. Most ceramic materials are plentiful and moderate in cost. The equipment can vary in expense, much of it can be made by the students, and it is durable. Within limits, as much can be invested in equipment as seems appropriate with proportionate results.

Usually those qualified to instruct in physics, chemistry, or art might, through extension courses, find ready orientation in ceramic fields. Suitable training may soon be available along these lines. There is now an extensive literature and an excellent national society.

An effort to work with local materials is made and an attempt to comprehend the scope of the industrial and vocational possibilities. The interrelationship with other arts and sciences is emphasized and the necessity of a thorough group of the basic arts and sciences dwelt upon.

Once comprehended (either as an art or a science), ceramics tends to grow into an obsession in many minds. No adequate basis for its strong and universal appeal has been suggested. Clayworking has always fascinated man, since neolithic time. It has continually intrigued and satisfied him. Concerned, as it is, with earth and water and air and fire, there is no field of science so rich in elemental appeal or so diverse and charming. No rock or clod is without significance when they may be crushed and mixed and wet and shaped and dried and fired into a new and marvelous product.

Nor is there an aspect more quickening to the cultural sense than the far sweep of history as it is revealed and made to breathe by the study of the influences affecting the development of ceramic form and design.

To the ceramist, a fragment of an urn from ancient Troy rolls back 7000 years as surely as his consideration of a syenite rock is made significant by his understanding of the temperatures and pressures under which such minerals form.

Ceramics is a broad and pleasant and fruitful field, as much calculated to elevate the mind as the income—equally able to enrich and empower the life.

This writer is sometimes troubled in spirit by much that is said and written about the industrial development of Arkansas. This ought to be done by our own boys and girls, as a companionate growth with our agriculture. Small native industry is the beginning and the end of all worth-while industrial development. And in the tomorrow, which some call the postwar days, all the ghosts of past mistakes and failures will rise to trouble a people who do not plan to produce effectively with that which is at hand.

Nature has endowed Arkansas with a wealth of ceramic raw materials. Much has been done and much more will be done. To give our own people a part in these future projects—to enrich the lives of many—to provide a vehicle for a hundred allied arts and sciences—these are some of the opportunities ceramics may offer you tomorrow.

ACTIVITIES OF THE SOCIETY

REPORT ON NOMINATIONS, MEETING OF BOARD OF TRUSTEES, DECEMBER 8, 1943

The following nominations have been submitted by representatives of the Divisions and Classes, also their proxies, selected by majority vote from the names submitted by the Special Committee, consisting of the present president and the two immediate past-presidents:

For President: E. H. FRITZ, Stupakoff Ceramic & Mfg. Co., Latrobe, Pa.

For Vice-President: C. FORREST TEFFT, Claycraft Co., Columbus, Ohio.

For Treasurer: JOHN D. SULLIVAN, Battelle Memorial Institute, Columbus, Ohio.

Explanatory Statement and Constitutional Amendments*

When the new Constitution of The Society was adopted in 1936, no material change was made in the manner of selecting the officers. The election, rather than the appointment, of Division representatives on the two nominating committees was made mandatory, but most Divisions already followed that practice. The system has given The Society good officers who have directed its affairs for continuing progress. Anyone who has been a member of one of the nominating committees, however, realizes that the present system is very haphazard, and it is surprising that it has been so successful. By its very nature there can be no continuity of policy.

* *Bull. Amer. Ceram. Soc.*, **21** [4] 54 (1942).

The Board of Trustees has discussed this matter for a number of years, and the discussion finally culminated in a resolution at the Executive Committee meeting held December 4, 1941, at Corning, N. Y.† At the request of President Littleton, acting under instructions of this resolution, the Rules Committee drafted the following amendment to Article VII, Section (1), of the Constitution‡ of The Society to be considered at the Annual Meeting in Cincinnati, as specified in Article XV:

Delete "The membership of THE SOCIETY shall elect annually . . .," and substitute therefor "The Board of Trustees of THE SOCIETY shall constitute. . . ." The Section will then read as follows:

"The Board of Trustees of THE SOCIETY shall constitute an Executive Nominating Committee, whose duty shall be, in the manner provided in the By-Laws, to propose candidates for the executive offices to be filled at each annual election."

The following amendment to Article III, Section (1) (*c*), of the Constitution is offered to make the subsection consistent with the intension and practice of the method of nominating Fellows:

In the second sentence of Subsection (*c*), Section (1), Article III, add before the first word "Members," the words "Fellows or," to make the sentence read as follows:

"Nomination to the grade of Fellow shall be by seven or more Fellows or Members, of whom four or more shall be Members of the Division with which the nominee is affiliated."

By-Laws Changes Adopted at 1942 Annual Meeting, Cincinnati, Ohio

Article B VII

(1) The Board of Trustees shall each year, by majority vote of those Trustees representing the Classes and Divisions of THE SOCIETY, propose candidates for the offices of President, Vice-President, and Treasurer. When the consent of the candidates has been received, the President shall transmit their names to the Editor of *The Bulletin*, so that they may be published ninety (90) days before the opening date of the next Annual Meeting.

(2) The names of the Trustees' nominees, together with the last date on which additional nominees can be accepted, shall be published in *The Bulletin* at least ninety (90) days before the opening date of the next Annual Meeting. Any twenty-five (25) voting members in good standing may, by signed petition, nominate an additional candidate for one or more of the offices, provided the petition, together with assurance of assent of the candidate or candidates, reaches the General Secretary of THE SOCIETY at least seventy (70) days before the next Annual Meeting.

(3) The method of electing the President, Vice-President, and Treasurer shall be as follows:

(*a*) The General Secretary shall prepare ballots as prescribed in the Rules and mail one to each member entitled to vote at least sixty (60) days before the opening date of the Annual Meeting. Only those ballots received at the office of THE SOCIETY more than seven (7) days before the opening date of the Annual Meeting shall be counted.

(*b*) The President shall appoint three (3) Scrutineers to count the ballots and report the results of the election to the President on or before the opening date of the Annual Meeting. A plurality of affirmative votes cast shall elect.

Rules Changes Adopted at 1942 Annual Meeting

Article R VII

(3)(*a*) The General Secretary shall prepare and distribute to each member entitled to vote a ballot for the election of President, Vice-President, and Treasurer, as provided in the By-Laws, Article B VII, Section (3)(*a*), which shall contain the nominees of the Board of Trustees and any additional nominees received as prescribed in the By-Laws, Article B VII, Section (2). The ballots shall be clearly marked and shall contain full instructions to the voter, and the nominees of the Board of Trustees shall be so indicated. The instructions shall contain the closing date of the polls for that particular election, as fixed by the By-Laws, Article B VII, Section (3)(*a*).

Only those ballots properly marked and sealed in a plain envelope labeled "Ballot for Society Officers," which in turn is sealed in an envelope on which the voter has signed his name in ink, shall be valid.

(*b*) Ballots shall be returned to the General Secretary, who shall check the signatures on the outside envelopes, discarding any returned by those not entitled to vote. The General Secretary shall then remove the outer envelopes from the valid ballots and surrender the inner envelopes, unopened, to the Scrutineers as soon as they are appointed.

The Scrutineers shall open the inner envelopes, count those ballots properly marked, and immediately report to the President the total vote for each candidate.

REPORT OF RULES COMMITTEE, DECEMBER 6, 1943

The preceding changes in the By-Laws and Rules have not heretofore been published in *The Bulletin* pending action in regard to simplifying the ballots of the various parts of The Society. At the Uniontown meeting, the Board decided to combine all ballots for Division officers with the ballot for the officers of The Society. The following amendments to the Rules implement this action but should be formally approved at the meeting in Columbus December 8:

Article R VII, Section (3)(*a*), should now read:

"The General Secretary shall prepare and distribute to each member entitled to vote a ballot for the election of the President, Vice-President, and Treasurer of THE SOCIETY, and the officers of the Divisions. The ballot shall contain the nominees for the three officers of THE SOCIETY made by the Board of Trustees, any additional nominees received as prescribed in the By-Laws, Article B VII, Section (2), and the nominees for Division officers forwarded to the General Secretary by the Chairman of the respective Divisions as specified in Article R X, Section (2), hereof. The member shall vote only for the officers of the Division with which he or she is affiliated. The ballots shall be clearly marked and contain full instructions to the voter, and the nominees of the Board of Trustees shall be so indicated. The instructions shall contain the closing date of the polls for that particular election as fixed by the By-Laws, Article B VII, Section (3) (*a*)."

"Only those ballots properly marked and sealed in a plain envelope labeled 'Ballot for Society and Division Officers,' which in turn is sealed in an envelope on which the voter has signed his name in ink, shall be valid."

Article R VII, Section (3)(*b*):

To the last paragraph should be added the sentence "The President shall immediately notify each Division Chairman of the number of votes cast for each candidate for office in his respective Division."

Article R X, add new Section (2) as follows:

"(2) Each Division shall each year nominate candidates for such of the following officers as its Division Rules may currently require and in the manner prescribed in said Division Rules. The names of those candidates consenting shall be forwarded by each respective Division Chairman to the General Secretary of THE SOCIETY at least 70 days before the opening date of the next Annual Meeting.

Trustee Representative (when required)
Chairman
First Vice-Chairman
Second Vice-Chairman
Secretary

† *Bull. Amer. Ceram. Soc.*, **21** [2] 22 (1942), motion made by G. W. Morey.

‡ *Ibid.*, **17** [10] 385–87 (1938).

Division Executive Committee Members at Large."

Another question arises. The Constitution in Article VII, Section (4), provides that the Classes and Divisions elect Trustee representatives (in those years required) 30 days before the Annual Meeting. This was done to insure, as far as possible, the attendance of the newly elected Trustees at the said meeting. By electing these Trustees as part of the Division Ballot on the combined form with the officers of The Society, and since the closing date of the polls is stated as 7 days before the Annual Meeting, we violate the Constitution. Since the Trustees can change the By-Laws, but not the Constitution, I would suggest changing the words "seven (7)" in Section (3)(*a*) of Article B VII to read "thirty (30)."

To carry out the purposes of the early closing date, the time of the report of the Scrutineers to the President, as provided in Section (3)(*b*) of Article B VII should be moved up. I recommend that the words "on or before the opening date of the Annual Meeting" be changed to read "at least fifteen (15) days before the opening date of the Annual Meeting." This would permit notifying the successful candidates for the Board of Trustees.

I am listing below the several "deadline" dates obtaining this year:

90 days before opening date of Annual Meeting—before January 3, 1944. (Trustees must make selection of candidates.) (Division Nominating Committees should report to their Division chairmen.)

70 days before opening date of Annual Meeting—before January 23, 1944. (General Secretary must have published names of nominees for officers of The Society.)

60 days before opening date of Annual Meeting—before February 2, 1944. (Ballots must be mailed.)

30 days before opening date of Annual Meeting—before March 3, 1944. (Proposed closing date of polls.)

15 days before opening date of Annual Meeting—before March 18, 1944. (Proposed deadline for report of Scrutineers.)

7 days before opening date of Annual Meeting—before March 3, 1944. (Present closing date of polls.)

Respectfully submitted,

W. KEITH MCAFEE, *Chairman,*
Rules Committee, American Ceramic Society

WHITE WARES DIVISION NOMINATIONS FOR OFFICERS, 1944–1945

Chairman: J. W. WHITTEMORE, Virginia Polytechnic Institute, Blacksburg, Va.

Secretary: C. M. LAMBE, JR., University of North Carolina, Raleigh, N. C.

*Trustee**

J. W. HEPPLEWHITE, Edwin M. Knowles China Co., Newell, W. Va.

R. F. SHERWOOD, United Feldspar & Minerals Corp., New York, N. Y.

* One to be elected.

GLASS DIVISION NOMINATIONS FOR OFFICERS, 1944–1945

Chairman: K. C. LYON, Armstrong Cork Co., Millville, N. J.

Vice-Chairman: LOUIS NAVIAS, General Electric Co., Schenectady, N. Y.

Secretary: S. R. SCHOLES, New York State College of Ceramics, Alfred, N. Y.

Trustee: J. S. GREGORIUS, Pittsburgh Plate Glass Co., Pittsburgh, Pa.

Our Families, Friends and Associates
Are Depending on Our Abilities
Today and V-Day

To Let Down in an Effort to Achieve
Is a Serious Letdown of Dependents

To Fare Mutually
We Share Mutually
Thus Manifolding Our Abilities

Come—Let Us Convene Together April 2, 3, 4 and 5

MATERIALS AND EQUIPMENT DIVISION NOMINATIONS FOR OFFICERS, 1944–1945

Chairman: J. R. KAUFFMAN, Allied Engineering Co., Milltown, N. J.
Vice-Chairman: J. F. DAY, 1901 Dresden Rd., Zanesville, Ohio.
Secretary: V. J. ROEHM, 2353 Ridgewood Ave., Alliance, Ohio.

Nominating Committee

J. F. MCMAHON, New York State College of Ceramics, Alfred, N. Y.
E. M. RUPP, Yancey Cyanite Co., Burnsville, N. C.

CERAMIC EDUCATIONAL COUNCIL

NOMINATIONS FOR OFFICERS, 1944–1945

For President: C. M. DODD, Iowa State College, Ames, Iowa.
For Vice-President: A. I. ANDREWS, University of Illinois, Urbana, Ill.
For Secretary: P. S. DEAR, Virginia Polytechnic Institute, Blacksburg, Va.
For Trustee: R. M. CAMPBELL, New York State College of Ceramics, Alfred, N. Y.

LOCAL SECTION NEWS

SOUTHERN CALIFORNIA SECTION

On November 13, 1943, members of the Southern California Section visited the Kaiser Company's iron and steel plant at Fontana, Calif., for a tour through the plant. Approximately one hundred members attended, but owing to wartime conditions it was impossible to arrange a dinner meeting after the inspection trip.

—W. O. BRANDT, *Secretary*

BALTIMORE-WASHINGTON SECTION

The fall meeting of the Baltimore-Washington Section of The American Ceramic Society was held December 4, 1943, at the Longfellow Hotel, Baltimore, Md. W. R. Lester, vice-chairman, made arrangements for the meeting and presided. Forty-three members and guests attended.

Cecil E. Bales, president of the parent Society, brought the Section official greetings from The Society and personal greetings from Ross C. Purdy and the staff at Columbus.

Walter A. Weldon described to the assembly the Catalog of Chinese Art which Mr. Bales recently purchased for the permanent library of The Society and expressed the appreciation of The Society. The meeting gave Mr. Bales a rising vote of thanks.

The program was devoted to a discussion of "Ceramics in the War." Louis J. Trostel, of the General Refractories Co., Baltimore, Md., covered the role of refractories in the war. He pointed out that refractories are basic for most war industries. Steel production, from the coke oven and blast furnace through the open hearth to final heat-treating, requires about 50% of the total production of refractories. Power plants, oil refineries, gas producers, nonferrous metallurgy, and the ceramic industries account for most of the remainder. Altogether about 95% of the total output of the refractories industry is being used in the war effort.

Plants are now operating at full capacity and are producing a much better product than in the last war. No ersatz materials have been used, and no essential industry has suffered from a lack of refractories.

The industry has suffered little from shortages of raw materials. Domestic supplies of ganister rock for silica brick, fire clays (both flint and plastic), and high-alumina clays of the diaspore type are ample for present and anticipated needs. Domestic topaz is now being used to replace the kyanite formerly imported. Magnesia from sea water is being used for magnesite refractories, and high-magnesia dolomitic sinters are being produced from domestic raw materials. The chrome deposits of Cuba have been developed to the point where they are now supplying much of our needs. Altogether, the refractories industry can justly be proud of its achievements in this war.

Unfortunately, Rex Newcomb, of the War Production Board, Washington, D. C., who was to have discussed the role of the other ceramic industries in the war, was unable to be present because of a recent tonsillectomy. He had prepared a paper, however, which was read at the meeting by W. W. Coffeen, National Bureau of Standards, Washington, D. C.

Mr. Newcomb pointed out that the enamel industry has made a number of contributions to the war effort. Specific instances which he mentioned are (1) enameled hot-water tanks, which replace the zinc formerly used on galvanized tanks and prolong the service life of the steel used in the tanks, particularly in areas where the water is very corrosive; (2) enameled canteens, which replaced aluminum at a time when the supply of that metal was not sufficient to meet the needs of the rapidly expanding aircraft industry and other critical uses; and (3) enameled exhaust stacks and collector rings for aircraft, which replace critical stainless steel.

In addition, enamel has been used for such items as kitchenware for the Army and Navy, officer's mess kits for the Army, boundary markers for airports, and bulkheads for naval vessels. Many of the enamel flatware plants which formerly produced refrigerators, stoves, etc., are now entirely converted to war production, and many enamel furnaces are being used for heat-treating. The kitchenware industry has been kept busy supplying much of the civilian demand, for kitchenware is no longer being made from aluminum and stainless steel. Cooking utensils have been purchased in large quantities for the Army and Navy, Maritime Commission, Lend-Lease Administration, and Board of Economic Warfare.

New developments by the glass industry include glass ring, plug, and snap gauges, which are actually superior to the metal gauges formerly used because of their lighter weight, lower thermal expansion, and greater abrasion resistance. The fact that no burr is formed when glass is scratched increases the useful life of glass gauges over metal. Glass gauges are also easier to make, as the only machining required is the final grinding and polishing, whereas metal gauges must be machined from the rough. Flat glass has replaced metal for machine beds to form an accurate plane surface for machining and measuring machined parts. Flat glass is also being used to make built-up bathtubs. A new signal mirror, with a simple optical sighting device, has been developed for use by shipwrecked sailors and downed aviators on life rafts. With this device, which is now standard equipment on all lifeboats and life rafts, a beam of sunlight can be focused accurately on a rescue craft ten miles away.

Glass wool has been used by the armed forces in huge quantities for textiles; sound and heat insulation in planes, ships, and tanks; and as a filter material. One small but important use is as a filter for blood plasma in making transfusions in the field and in field hospitals.

The glass industry has done a remarkable job in supplying the optical glass required for the huge number of fire-control instruments used to aim the guns and bombs of our Army and Navy. The remarkable marksmanship of our forces is due in no small part to the excellent optical instruments used.

The glass container industry has been operating at more than full capacity all through the war and has not been able to catch up on orders yet. Many foods formerly packaged in tin are now packed in glass, with great savings in steel and tin.

Whiteware, such as spark plugs, high-tension insulators, and dry-pressed insulators for radio and Radar parts, has played an important role. Hand grenades and bombs of whiteware were not too successful. The new products developed for civilian consumption, such as jar caps, fireplace grates, and ceramic cooking ware, have met with varied success. The ceramic stove holds some promise for postwar use. A ceramic file was developed for breaking glass ampoules. This is a small use, but it has been responsible for considerable savings in high-quality steel.

In the discussion which followed Mr. Newcomb's paper, Walter A. Weldon of the Locke Insulator Co., Baltimore, Md., said that his company is now producing ceramic cooking ware of high-quality electrical porcelain and plans to continue making it after the war. He foresees a bright future for this product.

This company is also producing dry-pressed handles and knobs for metal and glass cooking ware. These handles are especially desirable because of their low thermal conductivity and because they are not damaged by heat, as are wood and plastic handles. Mr. Weldon also said that the Locke Insulator Company is now making dry-pressed dishes up to 8 in. in diameter, and he expects the dry-press process to be used increasingly for the manufacture of dinnerware.

—JOSEPH C. RICHMOND, *Secretary*

CERAMIC ASSOCIATION NEWS

CERAMIC ASSOCIATION OF NEW JERSEY

The following newly elected officers were installed at the annual meeting of the Ceramic Association of New Jersey held December 10, 1943, at Rutgers University, New Brunswick, N. J.:*

President: THOMAS H. MCKEOWN, E. I. du Pont de Nemours & Co., Inc., Electrochemicals Dept., Perth Amboy, N. J.
Vice-President: FRED BENTLEY, Trenton Potteries Co., Trenton, N. J.
Councillor: AUGUST STAUDT, Perth Amboy Tile Works, Perth Amboy, N. J.
Secretary-Treasurer: EDWARD P. MCNAMARA, Dept. of Ceramics, Rutgers University, New Brunswick, N. J.
Assistant Secretary: EMMA L. NAWROT, Dept. of Ceramics, Rutgers University, New Brunswick, N. J.

The retiring president, Herreld D. Thropp, Eureka Flint & Spar Co., Trenton, N. J., is chairman of the Executive Committee.

Elected to the Executive Committee with terms to expire in December, 1946, were the following:

V. B. CASE, Paper Makers Importing Co., Inc., Easton, Pa.
R. V. TAILBY, Architectural Tiling Co., Keyport, N. J.
H. H. FRAHME, General Ceramics Co., Keasbey, N. J.
CAPT. G. N. HOWATT, Army-Navy Electronics Production Agency, New York, N. Y.
G. E. CRAWFORD, Universal Sanitary Mfg. Co., Camden, N. J.

R. J. S. Barlow, Trenton, N. J., will fill the unexpired term of Fred Bentley.

* An account of this meeting was given on pp. 413–14 of the December, 1943, *Bulletin*.

NEW OFFICERS OHIO CERAMIC INDUSTRIES ASSOCIATION

The following officers of the Ohio Ceramic Industries Association were re-elected at the annual meeting of the Board of Trustees held October 22, 1943:

President: H. D. CALLAHAN, U. S. Quarry Tile Co., East Sparta, Ohio.
Vice-President: E. E. HILLYER, Clay City Pipe Co., Uhrichsville, Ohio.
Treasurer: G. R. ROBINSON, Hocking Valley Brick Co., Logan, Ohio.
Secretary: H. E. NOLD, Lord Hall, Ohio State University, Columbus, Ohio.

The following were elected by ballot to the Board of Trustees:

C. FORREST TEFFT, Claycraft Co., Columbus, Ohio, representing Common Brick.
ARTHUR A. WELLS, Homer Laughlin China Co., Newell, W. Va., representing General Ware.
J. LEO CHILD, Hancock Brick & Tile Co., Findlay, Ohio representing Drain Tile.
C. E. BALES, Ironton Fire Brick Co., Ironton, Ohio, representing Refractories.
B. T. BONNOT, Bonnot Co., Canton, Ohio, representing Machinery and Supplies.
E. E. HILLYER, Clay City Pipe Co., Uhrichsville, Ohio, representing Sewer Pipe.

NEW YORK SOCIETY OF CERAMIC ARTS

The annual exhibition of the New York Society of Ceramic Arts was held at the National Arts Club, New York, N. Y., December 7–22, 1943.

The program for the exhibition was as follows:

December 7: Opening reception.

December 8: "Ceramic Sculpture" by Edmond Amateis, president of the National Sculpture Society, and improvisations in clay by Carl Schmitz.

December 12: "Use of Ceramic Ornaments in Small City Gardens" by Mrs. Nellie B. Allen, landscape gardener.

December 15: Beethoven Anniversary Concert under the auspices of the National Arts Club.

December 19: "Oriental Ceramic Arts" by Phyllis Ackerman of the Iranian Institute.

December 22: Lecture by Richard Bach, Dean of Education and Museum Extension.

Convening Together

Makes Efforts of Each

More Effective

SYNERGISTIC THINKING PAYS

Two Minds Exchanging Thoughts Produce More Than
Two Minds Thinking Independently

Productive Thinkers Convene
To Obtain That Exchange Thought Dividend

"After V Day" Industrial Stability
Depends on Present-Day Investments in Knowledge

Hear Ye and Tell Others
Of the Increasing Numbers of Ceramists
Who Find Profit in These Synergistic Activities

Date of Record	Members Paid		Deferred	Subscriptions	Monthly Sales	Total Circulation
	Personal	Corporation				
December 21, 1942	2088	270	15	446	220	3039
February 21, 1943	2095	267	10	451	220	3043
September 21, 1943	2021	295	6	487	220	3029
October 21, 1943	2043	302	6	501	220	3072
November 21, 1943	2076	303	5	507	220	3111
December 21, 1943	2096	309	4	501	220	3130
Gain	8	39	11	55		91

The American Ceramic Society
Second War Conference,
April 2, 3, 4, and 5,
Hotel William Penn,
Pittsburgh, Pa.

Affords Opportunities to Increase
Abilities to Meet V-Day Problems

(1944)

MEMBERS IN SERVICE*

The following members of this Society are in fighting units of war service. There are several in service in Washington not included in this Service Roster. This list, which was begun September, 1942, and added to each succeeding month, is probably not complete, and we would appreciate information on other members.

(242) J. JOHN BROUK, Hydraulic-Press Brick Co., St. Louis, Mo.
(243) R. G. CRAWFORD, Homer Laughlin China Co., Newell, W. Va.
(244) CHARLES R. FILIPPI, University of Illinois, Urbana, Ill.
(245) TERRY GALANIS, Joseph T. Ryerson & Son, Inc., Buffalo, N. Y.
(246) EDWARD L. WOODALL, JR., North Carolina State College, Raleigh, N. C.

* These are in addition to the list published monthly, beginning with the September, 1942, *Bulletin*, with the exception of the June, 1943, issue.

NEW MEMBERS IN DECEMBER

Corporation

B. G. CORPORATION, Frank J. Fallon (voter), Ridgefield, N. J.
ROYAL CHINA, INC., W. H. Habenstreit (voter), Sebring, Ohio.
SALEM CHINA CO., F. W. McKee (voter), Salem, Ohio.
TAYLOR, CHARLES, SONS CO., C. R. Taylor (votor, Box 58, Annex Sta., Cincinnati 14, Ohio
VALENTINE, M. D., AND BROTHER CO., W. H. Peterson (voter), Woodbridge, N. J.
WALSH REFRACTORIES CORP., J. L. Crawford (voter), 4070 North 1st St., St. Louis 7, Mo.
WATT POTTERY CO., Crooksville, Ohio.

Personal

ANDREWS, CLIFFORD M., 204 Ceramics Bldg., University of Illinois, Urbana, Ill.; special research assistant professor.
BÁEZ, JOSÉ D., Fabrica de Loza "El Anfora" S. A., Apartado 508, Mexico, D. F., Mexico.
BROWN, DONOVAN P., 12023 Lake Shore Blvd., Cleveland, Ohio; ceramic engineer, North American Refractories Co.
CARNES, KENNETH C., 2643 Wesleyan Dr., Toledo, Ohio; purchasing agent, Toledo Engineering Co., Inc.
CLAY, WILFRED, 302 Patterson Court, Takoma Park, Md.; National Bureau of Standards.
GLOVER, WILLIAM S., Westinghouse Electric & Mfg. Co., Fairmont, W. Va.
GRAGEDA, JOSE T., Inter-American Training Administration, 734 15th St., N. W., Washington 5, D. C.; industrial chemist.
GREGER, HERBERT H., 4410 Macomb St., N. W., Washington 16, D. C.; director of research, Briggs Clarifier Co.
*HERTZELL, E. A., 1104 N. Walnut St., Dover, Ohio.
HILL, VINCENT J. D., 34 Nightingale Rd., Carshalton, Surrey, England; Philips Lamps, Ltd.
HUGHES, LT. GEORGE B., 323 Washington St., Cedar Falls, Iowa.
MCKINNIE, JAMES R., 804 San Ysidro, Upland, Calif.; Kaiser Co., Inc.
MOCKRIN, ISADORE, 5409 Cathedral Ave., N. W., Washington, D. C.; National Bureau of Standards.
MÖHL, HELMUTH, Fabrica de Loza "El Anfora" S. A., Apartado 508, Mexico, D. F., Mexico.
PITTMAN, FRANK K., Corhart Refractories Co., 16th & Lee Sts., Louisville 10, Ky.
*RUPP, EDWIN M., Yancey Cyanite Co., Burnsville, N. C.
*SMITH, PAUL L., Sound Div., Naval Research Laboratory, Washington, D. C.
*VOORHIES, JOHN H., 4770 Kester Ave., Sherman Oaks, Calif.; Gladding, McBean & Co.
WATKINS, GEORGE B., Libbey-Owens-Ford Glass Co., Technical Bldg., 1701 E. Broadway, Toledo, Ohio; director of research.
*WATTS, LT. ARTHUR P., Ruxton, Baltimore 4, Md.

Student

University of California: Mrs. F. M. BENAS.
Ohio State University: E. JOSEPH WEISS.

MEMBERSHIP WORKERS' RECORD

CORPORATION: C. E. Bales 2, W. P. Charbonnier 1, F. J. Fallon 1, F. C. Henderson 1, W. R. Malkin 1, D. E. Walsh 1.
PERSONAL: D. G. Bennett 1, C. M. Dodd 1, R. F. Evans 1, George Ferdinand 1, F. W. Glaze 1, P. G. Herold 1, R. A. Jacobs 1, E. C. Petrie 1, Z, H. G. Schurecht 1, Office 11.
STUDENT: A. S. Watts 1, W. M. Cohn 1.
GRAND TOTAL: 29.

* Indicates former member of The Society rejoining.

ROSTER CHANGES FOR DECEMBER†

ARNOLD, A. R., 515 Carolina Ave., Chester, W. Va. (East Liverpool, Ohio)
BOERNER, A. R., Bridgeville Glass Works, General Electric Co., Bridgeville, Pa. (Cleveland, Ohio)
BROWN, DAVIS, Room 516, 426 S. Spring St., Los Angeles 13, Calif. (Bucyrus, Ohio)
CLARK, HORACE N., Refractory & Insulation Corp., 120 Wall St., New York 5, N. Y. (Port Kennedy, Pa.)
CONNELL, GEORGE A., 510 West 6th St., Los Angeles, Calif. (New York, N. Y.)
HOSTETTER, J. C., Mississippi Glass Co., Main & Angelica Sts., St. Louis 7, Mo. (Hartford, Conn.)
KRIEGEL, MAJOR W. W., Camp Davis, N. C. (New Orleans, La.)
LIMES, CAPT. ROBERT W., 0-329084, A.P.O. 563, c/o Postmaster, New York, N. Y. (Camp Forrest, Tenn.)
PINNOW, HARLEY R., Orangeville, Ill. (Derry, Pa.)
PUPULIDY, ALEX, Harbison-Walker Refractories Co., Box 357, Chester, Pa. (Fairfield, Ala.)
REIF, RICHARD E., 62 Washington Ave., Box 289, Berlin, N. J. (Dover, Ohio)
SCHURECHT, H. G., Champion Spark Plug Co., Butler Ave. & Grand Trunk R.R., Detroit 11, Mich. (Alfred, N. Y.)
SIEGWALD, CLYDE R., Upland Ave., Park, W. Va. (Clarksburg, W. Va.)
STEIN, NORMAN, Rossmor, Grantown-on-Spey, Scotland (Langgarth, Stirling, Scotland)
WATKINS, JOEL H., Charlotte C. H., Va. (Raleigh, N. C.)

† Address in parentheses is former address.

HOYT C. HOTTEL—EDWARD ORTON, JR., FELLOW LECTURER

Forty-Sixth Annual Meeting—War Conference, Pittsburgh, Pa., April 2–5, 1944

The 1944 Orton Fellow Lecture will be delivered by Hoyt C. Hottel, Professor of Fuel Engineering at the Massachusetts Institute of Technology, Cambridge, Mass., on the general subject of the transfer of heat by radiation.

Biography

Professor Hottel was born at Salem, Ind., January 15, 1903. He took his A.B. degree in chemistry at Indiana University in 1922 and a Master's degree at the Massachusetts Institute of Technology in 1924. Since 1928, he has been in charge of the work in fuel engineering under the Department of Chemical Engineering at the Institute. For the past few years, he has had a special assignment for research work under an endowment established at the Institute by Godfrey L. Cabot for the study of the utilization of solar energy. At present, he is doing research work for the National Defense Research Committee of the Office of Scientific Research and Development.

Hoyt C. Hottel

Publications of Professor Hottel

(1) "Heat Transmission by Radiation from Nonluminous Gases," *Trans. Amer. Inst. Chem. Engrs.*, **23,** 173–205.(1927).

(2) "Heat Transmission by Radiation from Nonluminous Gases," *Ind. Eng. Chem.*, **19,** 889–94 (1927).

(3) "Radiant Heat Transmission," *Mech. Eng.*, **52,** 699–704 (1930).

(4) "Radiant Heat Transmission," *Trans. World Power Conf., 2nd Conf., Berlin, 1930,* **18,** 47–48 (1930).

(5) "Application of Optical Pyrometry to the Measurement of Luminous Flame Radiation and Temperature," *Proc. Amer. Gas. Assn.*, **1930,** 1172–76.

(6) "Radiant Heat Transmission Between Surfaces Separated by Nonabsorbing Media," *Trans. Amer. Soc. Mech. Engrs.* [*Fuels Steam Power Div.*], **53,** 265–73 (1931).

(7) (With D. W. Wilson and W. E. Lobo) "Heat Transmission in Radiant Sections of Tube Stills," *Ind. Eng. Chem.*, **24,** 486–93 (1932).

(8) (With F. P. Broughton) "Determination of True Temperature and Total Radiation from Luminous Gas Flames," *Ind. Eng. Chem., Anal. Ed.*, **4,** 166–75 (1932).

(9) (With J. D. Keller) "Effect of Reradiation on Heat Transmission in Furnaces and Through Openings," *Trans. Amer. Soc. Mech. Engrs.* [*Iron and Steel Div.*], **55,** 39–49 (1933).

(10) "Heat-Transfer by Radiation," *Chem. & Met. Eng.*, **41,** 317–18 (1934).

(11) (With C. M. Tu and H. Davis) "Combustion Rate of Carbon: I, Combustion of Spheres in Flowing Gas Streams," *Ind. Eng. Chem.*, **26,** 749–57 (1934).

(12) (With H. Davis) "Combustion Rate of Carbon: II, Combustion at a Surface Overlaid with Stagnant Gas," *ibid.*, pp. 889–92.

(13) (With W. H. McAdams) "Development of the Unit Operations of Chemical Engineering. Heat Transfer," *Chem. & Met. Eng.*, **42,** 218–19 (1935).

(14) "Thermal Radiation, Subject Matter and Laboratory Technic," *Jour. Eng. Education,* **25,** 598–604 (1935).

(15) (With H. G. Mangelsdorf) "Heat Transmission by Radiation from Nonluminous Gases: II, Experimental Study of Carbon Dioxide and Water Vapor," *Trans. Amer. Inst. Chem. Engrs.*, **31,** 517–49 (1935).

(16) (With V. C. Smith) "Radiation from Nonluminous Flames," *Trans. Amer. Soc. Mech. Engrs.*, **57,** 463–70 (1935).

(17) (With F. W. Meyer and I. Stewart) "Temperature in Industrial Furnaces," *Ind. Eng. Chem.*, **28,** 708–10 (1936).

(18) (With Almon S. Parker) "Combustion Rate of Carbon. Study of Gas-Film Structure by Microsampling," *ibid.*, pp. 1334–41.

(19) (With R. L. Hershey and J. E. Eberhardt) "Thermodynamic Properties of the Working Fluid in Internal-Combustion Engines" *S.A.E. Journal,* **39,** 409–24 (1936).

(20) (With T. B. Drew and W. H. McAdams) "Heat Transmission," *Chem. Eng. Congr. World Power Conf. 1936,* No. **H7,** 33 pp.

(21) (With T. B. Drew and W. H. McAdams) "Heat Transmission," *Trans. Amer. Inst. Chem. Engrs.*, **32,** 271–305 (1936).

(22) (With J. E. Eberhardt) "A Mollier Diagram for the Internal-Combustion Engine," *Chem. Rev.*, **21,** 438–60 (1937).

(23) (With F. R. Russell) "Rate of Ethylene Polymerization," *Ind. Eng. Chem.*, **30,** 183–89 (1938).

(24) (With F. R. Russell) "Compressibility of Liquid Naphthalene," *ibid.*, pp. 343–45.

(25) (With H. C. Tsien) "Note on Effect of Hydrogen/-Carbon Ratio of Fuel on the Validity of Mollier Diagrams for Internal-Combustion Engines," *Jour. Aeronautical Sci.*, **5,** 203–207 (1938).

(26) (With I. McC. Stewart) "Space Requirements for the Combustion of Pulverized Coal," *Ind. Eng. Chem.*, **32,** 719–30 (1940).

(27) (With R. B. Egbert) "Radiation of Furnace Gases," *Trans. Amer. Soc. Mech. Engrs.*, **63,** 297–307 (1941).

(28) (With R. B. Egbert) "Radiant Heat Transmission from Water Vapor," *Trans. Amer. Inst. Chem. Engrs.*, **38,** 531–68 (1942).

(29) (With B. B. Woertz) "Performance of Flat-Plate Solar-Heat Collectors," *Trans. Amer. Soc. Mech. Engrs.*, **64,** 91–104 (1942).

(30) (With A. Kalatinsky) "Temperature Measurement in High-Velocity Air Stream." Presented at a meeting of the American Society of Mechanical Engineers, December 3, 1943.

Patent

(With Henry M. Nelly, Jr.) "Combined Regenerator and Catalyst Chamber Suitable for Use in Producing Carbon Monoxide and Hydrogen from Carbon Dioxide and Methane," U. S. 2,230,467, Feb. 4, 1936.

EDWARD STEIDLE

It is men of vision, energy, and social consciousness who succeed in doing the unusual. To follow requires only unimaginative sticking to a schedule as formulated by others. To lead, one must have the vision of the need and have the ability, energy, and social consciousness to make changes.

Change is one of the most certain of human experiences.

Leadership requires a lot of willingness to serve with others. One serves self best when he serves with others, but to serve effectively he must have his visions shared by his fellow servitors.

Edward Steidle is a leader in whom his constituency and fellow workers have confidence. All are equal shareholders. Thus the School of Mineral Industries at Pennsylvania State College has developed from an ordinary collegiate department of mining and metallurgy.

Personal Record of Edward Steidle as of January 1, 1944

(1) Born Williamsport, Pa., June 23, 1887, the son of Michael and Ellen Mary Eck Steidle. Married Ellen May Girsham (Kappa Alpha Theta, Allegheny College, 1914) July 29, 1920. Two children, Edward, Jr., 22, and Howard, 20.

(2) Attended Williamsport public schools and was graduated from Williamsport High School in 1907.

(3) Was graduated from The Pennsylvania State College, B.S. degree in Mining Engineering, in 1911. Also received the professional degree, Engineer of Mines, in 1914.

(4) Received the D.Sc. degree, Alfred University, Alfred, N. Y., December, 1943.

(5) Summers of 1908–1910, miner and mine sampler, Nipissing Mining Co., Ltd., Cobalt, Canada.

(6) Member of following college fraternities: Phi Delta Theta (social), Triangle (social-engineering), Druids (honorary sophomore), Tau Beta Pi, Sigma Tau, Theta Tau (scholastic engineering), Pi Eta Sigma (freshman scholastic), Scabbard and Blade (honorary military), and Sigma Gamma Epsilon (scholastic mineral industries).

(7) June, 1911, to October, 1912, miner and millman (stamp-cyanide), Sicorro Mining Co., Mogollon, N. Mex.

(8) October, 1912, to November, 1917, U. S. Bureau of Mines.

(*a*) 1912, foreman miner, Lake Superior District.

(*b*) 1913, junior mining engineer, Pittsburgh-West Virginia District.

(*c*) 1914, junior mining engineer, North West District.

(*d*) 1915, assistant mining engineer, San Francisco (constructed and supervised Bureau of Mines exhibits and "The Mine," Panama-Pacific International Exposition).

(*e*) 1916, assistant to chief mining engineer, Washington, D. C.

(*f*) 1917, mining engineer, Utah-Nevada-California District.

(9) November, 1917, to May, 1919, American Expeditionary Forces.

(*a*) Commissioned First Lieutenant, 30th Engineers, October 15, 1917.

(*b*) Sailed for France, November 15, 1917.

(*c*) December, 1917, to May, 1918, attached to Special Brigade, Royal Engineers, British Expeditionary Forces. Wounded in action once during this period.

(*d*) May, 1918, to May, 1919, Captain, First Gas Regiment (formerly 30th Engineers). Wounded in action once during this period.

(*e*) Returned to United States February, 1919. Commanding Officer 1st Battalion, First Gas Regiment. Mustered out at Lakehurst, N. J.

(*f*) Discharged from U. S. Army, Hospital No. 9, Lakehurst, N. J., May 1, 1919.

(*g*) Victory Medal embraces six battle clasps, viz., Somme Defensive, Aisne, Oise-Ainse, St.-Mihiel, Meuse-Argonne, and Defensive Sector.

(*h*) Pershing Citation Certificate for "exceptionally meritorious and conspicuous service during the Meuse-Argonne offensive."

(*i*) Member, "Order of Purple Heart" with palm.

(10) May 1, 1920, to July 1, 1928, consulting mining engineer. U. S. Bureau of Mines.

Dean Edward Steidle

(11) July 1, 1920, to July 1, 1928, consulting engineer, Mine Safety Appliances Co., Pittsburgh, Pa.

(12) Carnegie Institute of Technology, Pittsburgh, Pa., May 1, 1919, to July 1, 1928.

(*a*) Associate Professor of Mining Engineering in charge of Mining Department.

(*b*) Organized cooperative fellowship research in mining, fuel technology, and ferrous metallurgy with the Carnegie Institute of Technology, Pittsburgh Experiment Station, U. S. Bureau of Mines, and mining and metallurgical industries in Pittsburgh, Pa., district.

(*c*) Secretary, Mining and Metallurgical Advisory Boards, to Carnegie Institute of Technology and U. S. Bureau of Mines.

(13) Joined staff of The Pennsylvania State College on July 1, 1928, as Dean of the then School of Mining and Metallurgy. Present position, Dean, School of Mineral Industries.

(14) Program of the school reorganized in 1930 to embrace all branches of the earth sciences, mineral economics, mineral engineering, and mineral technology, and all

divisions of service, viz., resident instruction, correspondence and extension instruction, and research. Name of the school changed to School of Mineral Industries. A new $500,000 building was constructed for the work of the school in 1930. A $250,000 addition was added in 1939. Today the physical plant (building and equipment) is valued at $1,000,000.

(15) Organized the only mineral industries art gallery in the world, now comprising 165 original oil paintings of mineral industrial scenes in Pennsylvania.

(16) Member of following technical societies: American Institute of Mining and Metallurgical Engineers, Coal Mining Institute of America, Pittsburgh Coal Mining Institute, National Mine Rescue Association (President, 1942–1943), and Mine Rescue Veterans of the Pittsburgh District.

(17) Member of Center Hills Country Club, State College, Pa.

(18) Author of fifty-five bulletins and technical papers on prevention and limitation of mine explosives; mine safety and health; and mineral industries education.

(19) Visited thirty-three different countries (including five trips to Latin America).

(20) Recreation and hobbies: hiking, riding, camping, swimming, and traveling.

Mineral Industries Art Gallery Organized by Dean Steidle

Pennsylvania's appreciation of the work of Dean Steidle in organizing an art gallery of industrial paintings is shown in the following editorial and excerpts from a descriptive article entitled "Pennsylvania's Mineral Industries State College Art Gallery" which appeared in the *Bulletin of the Commonwealth of Pennsylvania, Department of Internal Affairs*, for October, 1943.

Editorial by William S. Livengood, Jr., Secretary of Internal Affairs

"Millions of words and countless photographs have been published to tell the story of Pennsylvania's industries, but it has remained for Dr. Edward Steidle, Dean of the Pennsylvania State College School of Mineral Industries, to assemble in one unique collection a gallery of paintings by noted artists depicting every phase of this State's wide variety of enterprises resting on our great store of natural resources.

"To Dean Steidle's vision and energy the people of this State are indebted for this contribution to our culture, which will become more and more valuable from a historical standpoint as technical developments tend to transform our methods of recovery and manufacture. Already we see in these paintings types of industry now obsolete or extinct and lost to posterity—especially to mineral arts students of the future—but for the pictorial records thus preserved.

"Pennsylvania's industry never is static. Always it is changing. Therefore the Steidle gallery never can be complete. Always there will be room for carefully chosen additions. Alumni or others interested could do no better than to see to it that Dr. Steidle's enthusiasm is matched by the dollars necessary to the extension of this remarkable work."

Excerpts from Article

"One hundred and sixteen original oil paintings, three oil murals, seven water colors, and twenty prints and drawings, the only collection of its kind in the world, now comprise the mineral industries gallery of the School of Mineral Industries at The Pennsylvania State College. The gallery shows the activities in Pennsylvania's far-flung mineral industries, as portrayed by an artist's brush, and constitutes a record of the mines, the mills, the oil wells, and other industries by which Pennsylvanians tap and convert into a useful form the vast mineral wealth that lies beneath the surface of their state.

Gifts Worth $50,000

"The paintings, recently appraised at more than $50,000, all were gifts to The Pennsylvania State College from artists, industries, alumni, or friends of the College, and the Works Progress Administration. Additional paintings are being contributed to the gallery constantly. Several prize-winning works in annual exhibits in Pennsylvania are now a part of the Penn State collection. These are not dreary pictures of depressing scenes but are vivid with scenic beauty, action, and color.

"In the early days of his present position, Dean Steidle began to work out a unified program for the School of Mineral Industries. One of his objectives in this new program was to provide 'educational forces' to help make the people of Pennsylvania more 'mineral conscious.' He established the mineral industries gallery as one means of attaining his objective.

"During the nine years that he lived in Pittsburgh, Dean Steidle attended all the art exhibitions held in that city. At each exhibition he noted the lack of paintings depicting industrial scenes. As a matter of fact, very few artists at that time were painting the industrial scenes so characteristic of Pennsylvania.

"Two great artists, John W. Alexander and Joseph Pennell, were almost alone in their honor of work. Joseph Pennell's etchings reproduced great constructive efforts, such as bridges, noble buildings, and Panama Canal scenes. John W. Alexander's murals in the Carnegie Institute in Pittsburgh depict powerful and dramatic industrial scenes.

Seventy-Five Artists Represented

"Dean Steidle began to interest artists in helping him accumulate a gallery of paintings devoted to the mineral producing and primary processing industries in Pennsylvania. Seventy-five Pennsylvania artists are now represented in the gallery.

"The paintings include scenes in and around coal mines, in both the bituminous and anthracite fields; views painted in the scorching heat of the steel mills, pictures of towering oil and natural gas rigs and other general panoramas in the Pennsylvania oil fields; and views of lime kilns, coke ovens, stone quarries, brick plants, glass works, and many other scenes of activities and objects. Virtually every section of Pennsylvania is represented.

International Recognition

"As the only gallery in the world devoted solely to mineral industry scenes, the Penn State collection has won international recognition and has been the subject of articles in several publications. Paintings from the collection have been used as cover pages for technical journals on five different occasions. They have been used also to illustrate articles in nine technical and industrial journals. *The Literary Digest* devoted a full page in 1935 to reproductions of six of the paintings.

"There are forty-two mining scenes, nine quarrying, sixteen petroleum and natural gas, eighteen ceramics, seventeen fuel technology, and fifty-two metallurgy. Some of the paintings already are of considerable historical significance in Pennsylvania. One is of the Diamond Colliery near Scranton, one of the oldest collieries in the anthracite region. Another shows one of the last beehive coke ovens to operate continuously in Pennsylvania.

Of Historic Interest

"A painting made at Johnstown represents one of the first by-product coke plants installed in this country. Another is of the now dismantled Schollenberg rolling mill on the Monongahela River, Pittsburgh. The Lucy Furnace, one of the oldest iron blast furnaces on the Allegheny River, Pittsburgh, and a picture of a typical old derrick at Titusville where oil was first discovered are also included. A painting of a gas well being 'brought in' somewhere in Potter County is a recent acquisition of the gallery.

"Another painting shows the 'secondary recovery' method of producing petroleum in the Bradford region, the first region to employ this method. Mules pulling pit wagons, a scene common to many small drift mines in western Pennsylvania, is characteristic.

"The gallery also includes views of a limestone quarry near Bellefonte, hand glass blowing at Pittsburgh, and the ladling and pouring of the large 200-inch telescopic reflector disk made by the Corning Glass Works.

Of Wide Popular Interest

"Prominent mineral industries leaders in Pennsylvania visit the School at Penn State regularly and are always enthusiastic about the gallery. Many admit their surprise that they did not realize the artistic beauty of some of the industrial scenes they see daily. After seeing the college collection, several industrial leaders have had similar scenes made for their offices. As Pennsylvania is the greatest mineral Commonwealth in the world, the portrayal of the mineral industries on these canvases will serve as an incentive to posterity, it is believed.

"The exhibit is a fortunate opportunity for the vast army of young people in our schools who are led through progressive educational experiences to an eager interest in mining operations and the processing of minerals as well. Fortunate are they to have these colorful visual aids to a better understanding of Pennsylvania's mineral industrial wealth.

"The artists represented are not alone recording the industrial scenes of today but are making a contribution as historians, having set down in some instances the passing scene for the information of future generations. We are living in a rapidly changing world.

"Dean Steidle has been the modest recipient of just praise for his vision, his stimulation of artists to paint industrial subjects. He has created not a picture but a collection of pictures united in its motivating theme. But he shares with the artists who have generously given their paintings and with representatives of industry, alumni, and friends of the College, the Works Progress Administration, and all who have cooperated in the realization of an idea which is destined to grow with each succeeding year.

"Formal opening of the Mineral Industries Art Gallery was held on March 30, 1942. J. Burn Helme, Professor of Fine Arts of the College, had charge of the program. Mrs. Lillian Parrish, concert pianist, rendered three piano selections. The Steinway piano was presented to the gallery as a memorial to the late John T. Ryan, Mining Engineer, class of 1908. The following dedicatory poem was read by the author, Theodore Roethke:

Here, on the cushioned wall,
In richly gilded frame,
Furnaces bulge and flare
Against a Pittsburgh night,
Diminish, cinder-charred;
Hard-pressed anthracite
Moves from a narrow vein
As fine-strung muscles heave;
Magyar, Welsh, and Lett,
Cunning technicians, tame
Metals richer than grain;
Glassworkers coddle and cool
A telescopic lens
To prove a star immense
And more than beautiful;
For whoever labors with ore,
Coal, clay, oil-bearing sand,
Probers of rock and air,
Live not by work alone;
Rig, tackle, pit-beast man,
Above or under earth,
Bring more than mineral forth,
More than the secret of stone."

SALUTE TO SOME OF OUR MEMBERS

CLARENCE P. AUSTIN

Vice-Chairman, Structural Clay Products Division

Only the high points of a long and varied career in the brickmaking industry are touched upon in this very brief account of the life of Clarence P. Austin, who was born in Elmira, N. Y., in 1895.

Clarence P. Austin

He studied economics at the University of Pittsburgh, spent two years in France with the United States 15th Engineers, and then came home to make brick at the Binghamton Brick Co., Inc., Binghamton, N. Y.

Although making brick is his principal occupation, he has taken many "side trips" into other manufacturing and sales ventures connected with refractories, roofing tile, drain tile, hollow tile, paving brick, sewer pipe, flue lining, and ceramic glazed ware.

At the moment, the activities of Mr. Austin, who is treasurer of the Binghamton Brick Company, are confined to the old "standbys" of face and common brick and to the problem of the reduction of iron ore into powder and pig iron. His company is also manufacturing porcelain container closures for the cosmetic trade.

Mr. Austin has been a member of The American Ceramic Society since 1936. He once before served as vice-chairman of the Structural Clay Products Division (in 1937–1938) and was a member of the Division Committee on Standards in 1942–1943.

FREDERICK WILDES ADAMS

Chairman, Committee on Standards, Glass Division

Frederick Wildes Adams was born March 3, 1901, in Canton, Mass. After attending the Newton (Mass.) High School, he entered the Massachusetts Institute of Technology, where he was graduated in 1921 in chemical engineering. He received the degrees of Master of Science and Doctor of Science in chemical engineering from the Massachusetts Institute of Technology in 1922 and 1928, respectively.

For fourteen years following the award of his Master's degree, he was associated with the Chemical Engineering Department at the same institution, successively occupying the posts of Director of the Bangor Station and Boston Station of the School of Chemical Engineering Practice,

where from 1926 to 1936 he held the rank of assistant professor. In this connection and as a consulting chemical engineer he was active in the fields of pulp and paper and heavy chemicals. For five years he was technical director of the Parker-Young Co., Lincoln, N. H., manufacturers of pulp and paper products. In 1936, he joined the staff of the Mellon Institute, Pittsburgh, Pa., as Senior Industrial Fellow in charge of the Multiple Fellowship on Plate Glass Technology.

Frederick Wildes Adams

Since January 1, 1943, he has been employed as chemical engineer by the Pittsburgh Plate Glass Co., Pittsburgh, Pa., and has devoted a large proportion of his time to the development of flat glass for lining tanks for the handling of corrosive and other solutions employed in the metal-finishing, electroplating, and chemical industries.

Mr. Adams has been active in The American Ceramic Society, the American Chemical Society, the American Institute of Chemical Engineers, the Technical Association of the Pulp and Paper Industry, the Electrochemical Society, the American Society for Testing Materials, and the American Co-Ordinating Committee on Corrosion. He is now actively working as a committee member in several of these organizations. He has published extensively in the technical literature in the fields of lime, pulp and paper, glass, heavy chemicals, heat-transfer, and other chemical engineering operations and has been granted patents in several of these fields.

He has been actively identified with civilian defense work as a member of technical committees of the City of Pittsburgh and the Western District of the Pennsylvania State Council of Defense and has contributed an outstanding publication on the "Behavior of Glazing Material Subjected to Explosion" which presents the results of extensive work on glass breakage conducted at Mellon Institute and sponsored by the Pittsburgh Plate Glass Company.

(1944)

WILLIAM V. BLAKE

Secretary, Michigan-Northwestern Ohio Section

William V. Blake, secretary of the Michigan-Northwestern Ohio Section since 1942, was born October 19, 1906, in Columbus, Ohio. He attended the Columbus public schools and received the B.Cer.E. degree from Ohio State University in 1929.

William V. Blake

Following graduation, he entered the employ of the Norton Co., Worcester, Mass., as assistant in the Manufacturing Control Department, Wheel Division. In 1930, he became associated with the Macklin Co., Jackson, Mich., as ceramic engineer and has been chief engineer for this same Company since 1936.

Mr. Blake has been a member of The American Ceramic Society since 1935 and is affiliated with the Materials and Equipment Division.

SANDFORD STODDARD COLE

Chairman, Nominating Committee, Materials and Equipment Division

Sandford Stoddard Cole was born in Cuba, N. Y., November 24, 1900. He received his grade school education at Cuba and Hornell, N. Y., and was graduated from Hornell High School in 1918. He entered the New York State College of Ceramics, Alfred, N. Y., in 1919 and received his B.S. degree in 1923.

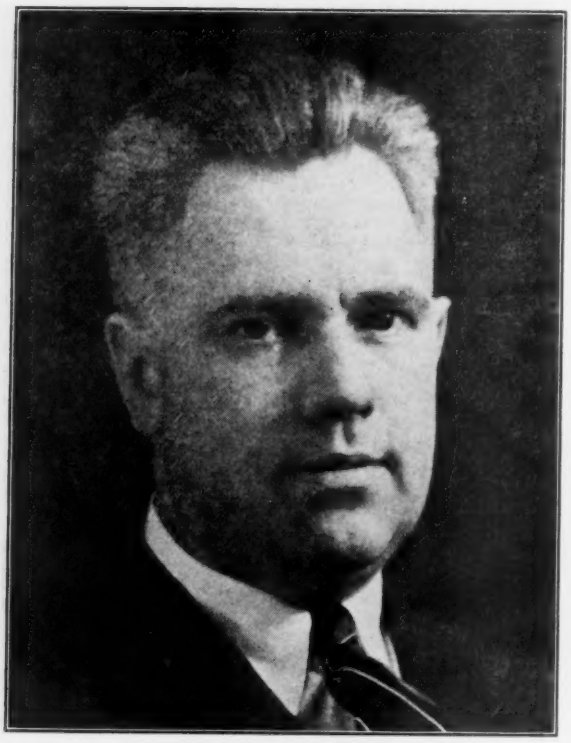
Following graduation, Dr. Cole was employed by the Koppers Company fellowship at Mellon Institute, Pittsburgh, Pa., and was engaged on research and development of silica refractories for coke ovens until the termination of the fellowship in 1932. He then entered graduate school at Alfred University, receiving his M.S. degree in 1933, and then transferred to the Pennsylvania State College, State College, Pa., where he received his Ph.D. degree in 1934.

Dr. Cole entered the employ of the National Lead Co., Titanium Division, South Amboy, N. J., upon receiving the doctorate and is now with this organization as group leader on research on titanium technology.

Dr. Cole, a Fellow of The American Ceramic Society and a member since 1923, has been active in the Refractories and Materials and Equipment Divisions, having served on various committees of both Divisions. He is also a charter member of the Institute of Ceramic Engineers, Keramos, Sigma Xi, and Phi Kappa Phi.

Publications

(1) "European Silica Refractories," *Jour. Amer. Ceram. Soc.*, **8** [1] 55–58 (1925).



Sandford Stoddard Cole

(2) "Note on Comparison of English vs. Orton Pyrometric Cones," *Jour. Amer. Ceram. Soc.*, [7] 462–63.
(3) "Properties of Silica Brick from Coke-Oven Walls," *ibid.*, **9** [4] 197–202 (1926).
(4) "Requirements of Refractories of Manufactured-Gas Plants," *ibid.*, [7] 462–73; reprinted in *Fuels and Furnaces*, **5** [1] 97–98; [2] 221–22; [3] 345–46 (1927).
(5) "Variations in Softening Points of Refractory Materials Due to Rate of Heating," *Jour. Amer. Ceram. Soc.*, **10** [3] 180–84 (1927).
(6) "Effect of Grain Size on Properties of Silica Cement," *ibid.*, [8] 644–50.
(7) "Elimination of Swelling in Determination of Coal-Ash Fusion Points," *Fuels and Furnaces*, **6** [7] 950 (1928).
(8) "Variations in Pyrometric Cone Equivalents of Silica Cements and Fire Clays," *Jour. Amer. Ceram. Soc.*, **11** [11] 855–58 (1928).
(9) "Abrasion Test for Silica Brick," *Proc. Amer. Soc. Testing Materials*, **29**, 288–89 (1929).
(10) "Thermal Expansion of Silica Brick and Mortars," *Jour. Amer. Ceram. Soc.*, **13** [7] 437–46 (1930).
(11) (With D. C. Lynn) "Thermal Expansion of Silica Mortars after Firing at 950°, 1200°, and 1500°C.," *ibid.*, **14** [12] 906–12 (1931).
(12) "Effect of Firing at 1500°C. on the Porosity and Specific Gravity of Quartzites," *ibid.*, **15** [2] 87–95 (1932).
(13) "Relation of Crushing Strength of Silica Brick at Various Temperatures to Other Physical Properties," *ibid.*, [11] 611–21.
(14) (With S. R. Scholes) "Rapid Method for Analysis of Siliceous Refractories," *ibid.*, **17** [5] 134–36 (1934).
(15) (With N. W. Taylor) "Crystalline B_2O_3," *Jour. Amer. Chem. Soc.*, **56** [7] 1648–49 (1934).
(16) "Conversion of Quartz into Cristobalite Below 1000°C. and Properties of the Cristobalite Formed," *Jour. Amer. Ceram. Soc.*, **18** [5] 149–54 (1935).
(17) "Recent Improvements in Physical Properties of Silica Brick, I–V," *Blast Furnace Steel Plant*, **23** [3] 221; [4] 288; [5] 352–53; [6] 429–30; [7] 498–99; [8] 573–74 (1935).
(18) (With D. A. Dickens and M. E. Holmes) "Variations in Pyrometric Cone Equivalent of Refractories After Reheating at Elevated Temperatures," *Bull. Amer. Ceram. Soc.*, **14** [4] 135–38 (1935).
(19) "Working Properties of Silica Mortars," *Jour. Amer. Ceram. Soc.*, **18** [2] 61–64 (1935).
(20) (With N. W. Taylor) "System Na_2O–B_2O_3: I, Preparation of Crystalline B_2O_3 and Some of Its Physical Properties," *ibid.*, **18** [2] 55–58 (1935); (with S. R. Scholes and C. R. Amberg) "II, Properties of Anhydrous and Hydrated Metaborates of Sodium and Potassium," *ibid.*, pp. 58–61; (with N. W. Taylor and S. R. Scholes) "III, Optical Properties, X-Ray Patterns, and Melting Points of Anhydrous Sodium Borates," *ibid.*, [3] 79–81; (with N. W. Taylor) "IV, Vapor Pressures of Boric Oxide, Sodium Metaborate, and Sodium Diborate Between 1150° and 1400°C.," *ibid.*, pp. 82–85.
(21) (With S. R. Scholes and C. R. Amberg) "Correction in Specific Gravity and Unit Cell Size of $Na_2O \cdot B_2O_3$," *ibid.*, **20** [6] 215 (1937).
(22) (With H. Espenschied) "Lead Titanate: Crystal Structure, Temperature of Formation, and Specific Gravity Data," *Jour. Phys. Chem.*, **41**, 445–51 (1937).
(23) (With W. K. Nelson) "System Zinc Oxide–Titanium Dioxide. Zinc Orthotitanate and Solid Solutions with Titanium Dioxide," *ibid.*, **42** [2] 245–51 (1938).
(24) (With W. W. Plechner) "Research Laboratory of the National Lead Co., Titanium Div.," *Ind. Eng. Chem., Anal. Ed.*, **11** [5] 299–302 (1939).
(25) (With C. A. Kumins) "Direct Determination of Vanadium in the Presence of Titanium and Iron," *Bull. Amer. Ceram. Soc.*, **20** [10] 329–31 (1941).
(26) (With C. E. Wood and T. L. Joseph) "Smelting of Vanadium-Bearing Titaniferous Sinter in an Experimental Blast Furnace," *U. S. Bur. Mines Repts. Investigations*, No. 3679 (Jan., 1943).

Patents

(1) "Cement," Can. 285,932, Dec. 25, 1928.
(2) "Refractory Product," U. S. 1,763,882, June 17, 1930.
(3) "Method of Making Refractory," U. S. 1,798,972, March 31, 1931.
(4) "Stand-Pipe Apparatus for Use in Distilling Carbonaceous Materials," U. S. 1,800,717, April 14, 1931.
(5) "Prevention of Clinkering of Coal," Can. 317,443, Nov. 24, 1931.
(6) "Solid Fuel," U. S. 1,924,180, Aug. 29, 1933.
(7) "Titanium Pigments," U. S. 2,184,938, Dec. 26, 1939.
(8) (With W. K. Nelson) "Preparation of Pigments Comprising Rutile Titanium Dioxide," U. S. 2,280,795, April 28, 1942.
(9) "Preparation of Rutile Titanium Dioxide," U. S. 2,290,539, July 21, 1942.
(10) "Preparation of Rutile Titanium Dioxide," U. S. 2,316,840, April 20, 1943.
(11) "Preparation of Rutile Titanium Dioxide," U. S. 2,316,841, April 20, 1943.

HENRY G. FISK

One of the first services to be undertaken by Henry G. Fisk, newly appointed director of the University of Wyoming Natural Resources Research Institute, Laramie, Wyo.,* will be the establishment of a laboratory for mineral identification and analysis, including testing and evaluation of Wyoming ceramic and mineral raw materials. During the winter months, Dr. Fisk will make a survey of the mineral resources of the State and will visit such properties as are accessible during this period. Later, as weather permits, all of the more important mineral-

* See *Bull. Amer. Ceram. Soc.*, **22** [12] 407 (1943) for the announcement of the appointment of Dr. Fisk and a summary of the objectives of this newly established Institute.

producing areas and prospects of the State will be visited with the object of becoming acquainted with operating and production problems and of aiding in more full commercial development of the mineral resources being exploited.

Henry G. Fisk

Biographical Sketch of Dr. Fisk

Henry G. Fisk was born in San Francisco, Calif., April 26, 1901, attended grade schools in Monterey and Monrovia, Calif., and was graduated from Occidental College in Los Angeles with a bachelor's degree in chemistry in 1923. During his last year in college, he served as chemist for the Vitrefrax Corporation, which was at that time pioneering in the development of electric-furnace fused refractory materials. In 1924, he received a master's degree in chemistry at the University of Illinois, Urbana, Ill. Having been appointed a Bureau of Mines fellow at the Ohio State University, he continued graduate study in ceramics and mineralogy at that institution, receiving a Ph.D. degree in mineralogy in 1927. On completing graduate study, Dr. Fisk became ceramic engineer for Gladding, McBean & Co., Los Angeles, Calif. In 1928, he accepted a position as petrographer for the Universal Atlas Cement Company in their research laboratory at Buffington, Ind. He remained there until 1936, when he went to the Calaveras Cement Company in California as research chemist. While there he developed a lightweight constructional material called Pumicell which was produced from an emulsified cement-pumicite slurry and hardened by steam curing. Following a short period of mining in California and Montana, Dr. Fisk went to the Armour Research Foundation in 1936 to undertake work on a dolomite investigation sponsored by the Marblehead Lime Company of Chicago. Dr. Fisk saw the phenomenal growth of the Armour Research Foundation from a staff of twenty-two persons to its present staff of more than two hundred under the able leadership of Harold Vagtborg. As the Foundation progressed, he took charge of the ceramic and nonmetals work of that institution, which position he held at the time of his appointment to the directorship of the Wyoming Natural Resources Research Institute.

Dr. Fisk has been a member of The American Ceramic Society since 1925, is a member of the Founders Group of the Institute of Ceramic Engineers, and served as chairman of the Chicago Section in 1941–1942. He is also a member of the American Institute of Mining and Metallurgical Engineers, the Mineralogical Society of America, and a fellow of the American Association for the Advancement of Science.

Publications

(1) "A Practical Gas-Fired Test Furnace for Plant Use," *Jour. Amer. Ceram. Soc.*, **9** [3] 151–53 (1926).

(2) (With A. S. Watts and R. M. King) "Study of Effect of Substitution of Calcined Ball Clay for Nonplastic in Porcelain and Talc Bodies," *ibid.*, **10** [1] 53–58 (1927).

(3) "Preparation and Purification of the Tri-Iodides of Antimony and Arsenic for Use in Immersion Media of High Refractive Index," *Amer. Mineralogist*, **15** [7] 263–66 (1930).

(4) "Preparation of Thin Sections of Portland Cement and Other Clinkers for Petrographic Examination," *Amer. Jour. Sci.*, **23**, 172–76 (1932).

(5) (With W. J. McCaughey) "Equilibrium Studies in Systems Containing Magnesium Oxide, Iron Oxide, and Magnesium Aluminate," *Ohio State Univ. Eng. Expt. Sta. Bull.*, No. 70, 44 pp. (July, 1932).

(6) "Physical Chemistry of Clinker Formation From the Standpoint of Equilibrium Diagrams," *Chemistry and the Cement Industry*, Pages 39–45, Chapter 12 (1933).

(7) "Petrographic and X-Ray Methods," *Chemistry and the Cement Industry*, Pages 46–48, Chapter 13 (1933).

(8) "Nature of Portland Cement Clinker," *Jour. Chem. Education*, **11** [4] 195–203 (1934).

(9) "Petrographic Methods," *Frontier*, **2** [2] 3 (June, 1939).

(10) "Refractories for Cement Kilns," *Cement & Lime Manuf.*, **13** [1] 13–18; [3] 51–54; [4] 74–76 (1940).

(11) (With Kenneth Rees) "Note on Cone Deformation Study in Part of the System Calcium Oxide-Iron Oxide," *Jour. Amer. Ceram. Soc.*, **23** [6] 185–86 (1940).

(12) "Ceramics and Industrial Minerals in the War Effort," *Jour. Chem. Education*, **19** [11] 510–12 (1942).

(13) "Ceramics and the War," *Science Counselor*, **8** [4] 98, 131 (Dec., 1942).

(14) "Refractories as They Relate to the Steel Industry," *Blast Furnace & Steel Plant*, **31** [12] 1385–90, 1424 (1943).

(15) (With W. C. Cress) "A Proposed Test for the Adherence of Enamel to Cast Iron." To be published in *The Bulletin of The American Ceramic Society.*

JOHN GEORGE SEANOR

Member, Nominating Committee, Structural Clay Products Division

John George Seanor was born in Darlington, Pa., August 5, 1894, and is the descendant of Scotch, Irish, and Pennsylvania Dutch pioneers who settled that State. He attended Geneva College at Beaver Falls, Pa., and after leaving college was employed by Fiske & Company at their Darlington, Pa., plant until he went overseas with the 6th U. S. Engineers in 1917. He served with the Australian Corps of the 5th British Army and with the 3rd U. S. Division after its arrival in France.

After his discharge from the army in June, 1919, Mr. Seanor served as superintendent of Fiske & Company's Darlington plant until 1924. During 1924 and 1925, he supervised the erection and put into operation the Alliance Brick Company's Darlington, Pa., plant. He was superintendent of the Wadsworth Brick & Tile Co., Wadsworth, Ohio, during 1926 and superintendent of The Hanley Company's Summerville, Pa., plant during 1927. He returned to the employ of The Alliance Brick Company in 1928 and was general superintendent of their affiliated plants in Pennsylvania until 1941, when he joined the organization of The Bonnot Company, Canton, Ohio, as representative.

Mr. Seanor has been a member of The American Ceramic Society since 1941.

Publications

(1) "Problem of Shading," *Brick & Clay Record*, **66** [10] 758 (1925).

(2) "Automatic Brick Cutters," *ibid.*, **78** [2] 91–94 (1931).

John George Seanor

Otis L. Jones, Chairman, Committee on Industrial Management, Refractories Division. For biographical sketch of Mr. Jones, see *Bull. Amer. Ceram. Soc.*, 22 [11] 381 (1943).

(3) "Firing a Brick Kiln More Efficiently, I–II," *Brick & Clay Record*, **87** [5] 156–57; [6] 198–99 (1935).
(4) "Delayed Combustion in Downdraft Kilns," *ibid.*, **92** [6] 26–28 (1938).
(5) "Too Many Brick Set in a Kiln Defeat Benefit of Long Flame," *Bull. Amer. Ceram. Soc.*, **19** [7] 245–47 (1940).
(6) "Speed of Auger Affects Quality of Ware," *Brick & Clay Record*, **97** [1] 20–21, 30 (1940); reprinted in *Brit. Clayworker*, **49** [582] 151–53 (1940).
(7) "Discussion of 'Draft in Burning Practice,' " by T. W. Garve: with L. R. Whitaker, *Brick & Clay Record*, **97** [2] 21–22 (1940); with W. S. Sells and L. R. Whitaker, *ibid.*, [3] 28–29; [4] 24–25.

JOSEPH CARL RICHMOND

Secretary-Treasurer, Baltimore-Washington Local Section

Joseph Carl Richmond was born May 29, 1913, in Farmers Valley, Pa. He attended schools in various small towns in Pennsylvania and New York and was graduated from high school at Limestone, N. Y., in 1929.

His college education began at Western Reserve University, Cleveland, Ohio. After two years, he transferred to Alfred University, Alfred, N. Y., where in 1935 he received B.S. degrees from both the New York State College of Ceramics (with Departmental honors in ceramic engineering) and the Liberal Arts College. He received his M.S. degree in Ceramic Engineering from the North Carolina State College of Agriculture and Engineering at Raleigh, N. C., in 1939.

Joseph Carl Richmond

Mr. Richmond was technical editor of *Brick & Clay Record* and *Ceramic Industry* for two years. Since 1939, he has been at the National Bureau of Standards, Washington, D. C., first in the Masonry Materials Section and now in the Enameled Metals Section.

He is an associate member of the Institute of Ceramic Engineers and a member of Keramos, the Colorists of Baltimore and Washington, and the Washington Society of Engineers. He has been a member of The American Ceramic Society since 1939.

Publications

(1) (With C. R. Amberg and H. D. Prior) "Adhesion of Enamel to Steel Produced by Electrodeposition of Mo-$(OH)_3$ on Steel," *Jour. Amer. Ceram. Soc.*, **20** [3] 75–76 (1937).

(2) (With J. W. McBurney) "Strength, Absorption, and Resistance to Laboratory Freezing and Thawing of Building Brick Produced in the United States," *Nat. Bur. Standards Bldg. Materials and Structures Rept.*, BMS60, 56 pp. (Nov. 5, 1940).

(3) (With J. W. McBurney) "Effect of Freezing Temperature in Freezing-and-Thawing Tests of Brick," *Proc. Amer. Soc. Testing Materials*, **41**, 967–74 (1941).

(4) (With W. H. Herschel and J. B. Peterson) "An Improved Volumenometer," *Jour. Amer. Ceram. Soc.*, **26** [4] 127–31 (1943).

SAMUEL FORMAN WALTON, SR.

Chairman, Rules Committee, and Member, Committee on Membership, Refractories Division

Samuel Forman Walton, Sr., was born in Germantown (Philadelphia), Pa., July 30, 1888, the fifth son of a six-son family, but his first recollections are of a small country town, Washington, Iowa, where he was brought up, attended public school ("The Heights"), and was graduated from high school in 1907. He claims that he was no particular "great shakes" as a student. In the fall of

Samuel Forman Walton, Sr.

1907, he went to California, where he was caught in the panic of that year, but he helped put through the Western Pacific as "stake artist" and chainman.

"Ames" Alumnus

While Mr. Walton was in California, one of his older brothers, a graduate of Iowa State College, Ames, Iowa, sent him a catalogue of that school and he decided to take the course in ceramic engineering for no other reason than that it was the youngest engineering course and should not be overcrowded. His entrance class in 1908 of some 600 students was the largest freshman class to enter Iowa State College up to that time. There were only about 1800 men and 300 women four-year students on the campus.

The Ceramic Department was so new that there was only one junior, Milton F. Beecher, and no seniors. Mr. Walton was the first to sign up for the course as a freshman. Mr. Beecher had transferred from one of the older engineering courses. William E. Dornbach transferred later and was graduated in 1911, and George A. Loomis, the other member of the class, transferred in his sophomore year.

Dean Byers, head of the Mining Engineering Department, had organized the Ceramic Engineering Department, but the active instruction was given by Ira Williams. The freshman year was practically the same for all engineering students, and a seminar was held with the "miners." Starting with their sophomore year, the ceramic students received special instruction in ceramics from Professor Williams, but Mr. Walton continued to take mining with the miners, civil engineering and structures with the civil engineers, mechanics and physics with the mechanical engineers, and chemistry with the chemical engineers. At the time he was graduated, he determined that by going back for one more year and taking special courses he could have had three other engineering degrees, mining engineering, mechanical engineering, and civil engineering, for he would have had enough credits. Needless to say, he did not.

The course in ceramics was tutored. The only printed textbook was H. Ries' book entitled Clays, Occurrences and Uses. The daily lectures were mimeographed notes prepared by Professor Williams.

In Mr. Walton's senior year, Professor Williams took a leave of absence due to illness. A German-born engineer, who was a specialist in his line, was brought in to help Mr. Loomis and Mr. Walton in their theses and to teach them clayworking machinery, plant layout, and design. Mr. Beecher returned as instructor and taught clayworking and glazes. This was again a tutored course.

Mr. Loomis and Mr. Walton were graduated in June, 1912, and Mr. Walton was the honor student of his Department.

Society Memberships and Honors

In 1911, as a junior, Mr. Walton joined The American Ceramic Society as an associate member, but the membership lapsed after graduation. He took it up again in 1917, and has been a member ever since. In 1935, he was elected to the Fellowship. He is a charter member of the Institute of Ceramic Engineers and past-chairman of the Refractories Division, having worked up through the various offices from chairman of the Program Committee. He was also chairman of the Entertainment Committee for the Annual Meeting of The Society held in Buffalo in 1935.

In 1942, he received the professional engineering degree from the New York State College of Ceramics, Alfred, N. Y., and in the fall of 1943, he was initiated as honorary member of the local chapter of Keramos at Alfred University.

At its annual meeting last fall, he was elected president of the Ceramic Association of New York, with which organization he has been affiliated since its inception. He is also a member of the board as the representative of the raw material producers.

Business Career

In his business career, Mr. Walton spent the first four years studying the manufacture and firing of sewer pipe, brick, hollow tile, and clay refractories on jobs in the Middle West to the Northwest and back again to the Middle West, then in the Eastern States. He also tried his hand at construction work and selling face brick and refractories. In 1916, he joined the technical staff of the Carborundum Co., Niagara Falls, N. Y. After leaving this Company in 1919, he spent three years with Kalmus, Comstock and Wescott, industrial engineers of Boston, Mass. While associated with this Company, he was secretary of the New England Branch of The American Ceramic Society and wrote the letter to General Edward

Orton, Jr., recommending Ross C. Purdy as permanent Secretary of The Society.

He left Boston in 1923, helped run a clay plant in Pennsylvania, and initiated Revivo, the clay successfully used to revive molding sand. He also produced an artificial molding sand which was commended by Dr. Moldenke and used extensively in western Pennsylvania and western New York State.

In 1925, he started in business for himself as a refractory engineer in Philadelphia, but in 1927 he sold out this business and became associated as ceramic engineer with The Exolon Co., Tonawanda, N. Y., manufacturers of abrasives and refractories. In July, 1943, he started his seventeenth year with this Company as ceramic engineer and technical director. In these intervening years, silicon carbide refractories have shown a steady increase in serviceability, and he has had some part in making this serviceability possible.

Son in Army

In June, 1920, Mr. Walton married Alice Dunnel Osann and they have one son, Samuel F. Walton, Jr., who is a corporal (technician 5th class) in the 291st Ordnance Company of the U. S. Army.

Revealing Signature

A "world-famous graphologist" (by her own admission) had this to say in part after inspecting Mr. Walton's signature:

"Always a step or two ahead of the other fellow, you are keen, alert, and shrewd. You are tenacious and you insist upon a full understanding of things. You are not easily persuaded or influenced by the seeming. Your nature is a bit too stubborn and firm for that. You seek the facts and are both argumentative and skeptical until a point is proved."

Mr. Walton says that sometimes he almost agrees with her.

Publications

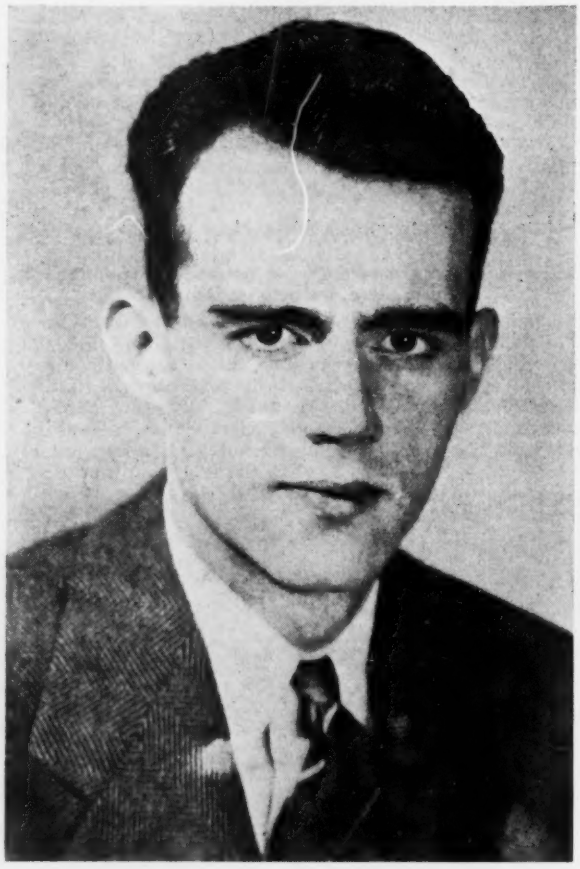
(1) "Construction of a Novel Testing Furnace," *Jour. Amer. Ceram. Soc.*, **3** [10] 833–36 (1920).
(2) "New Use for Refuse Refractory Material," *Iron Age*, **113**, 786–88 (1924).
(3) "Refractories in Industry," *Philadelphia Purchaser*, 1927.
(4) "Silica Brick," *ibid.*
(5) (With E. L. Hauman) "Effect of Silicon Carbide in Clay Bodies," *Jour. Amer. Ceram. Soc.*, **13** [12] 935–40 (1930).
(6) (With H. E. White) "Particle Packing and Particle Shape," *ibid.*, **20** [5] 155–66 (1937).
(7) "Story of Abrasives," *Monthly Rev. Amer. Electroplaters' Soc.*, **27**, 841–51 (1940).

Patents

(1) "Coal Retort Lining," U. S. 1,528,351, March 3, 1925.
(2) "Manufacture of Silicon Carbide Refractories," U. S. 1,528,352, March 3, 1925.
(3) "Reclamation of Abrasive Materials," U. S. 1,718,264, June 25, 1929.
(4) "Moldable Product and Method of Producing," U. S. 1,781,204, Nov. 11, 1930.
(5) "Nonweathering Glazed Aggregate and Method of Preparing," U. S. 1,855,210, April 26, 1932; reissued as U. S. 19,372, Nov. 13, 1934.
(6) "Nonweathering Pigment and Method of Preparing," U. S. 1,855,211, April 26, 1932.
(7) "Method of Applying Protective Refractory Glaze to Refractory Bodies Containing Silicon Carbide," U. S. 1,868,451, July 19, 1932.
(8) "Production of Abrasive Flours," U. S. 1,875,531, Sept. 6, 1932.
(9) "Turbulent Radiant Combustion Chamber," U. S. 1,970,529, Aug. 14, 1934.
(10) "Refractory," U. S. 2,246,226, June 17, 1941.
(11) "Refractory," Can. 406,963, Aug. 25, 1942.

NORMAN L. HALDY

Norman L. Haldy, a member of The American Ceramic Society since 1940, has been appointed to the research staff of Battelle Memorial Institute, Columbus, Ohio, and assigned to its Division of Ceramic Research.



Norman L. Haldy

A graduate of Ohio State University with Bachelor and Master degrees in ceramic engineering, Mr. Haldy was formerly associated with the Walker China Co., Bedford, Ohio. He has also had working experience with the W. K. Carter Co., Columbus, Ohio, and the Universal Sanitary Mfg. Co., New Castle, Pa.

At Battelle, he will conduct research in the improvement of whiteware bodies.

F. L. MEACHAM JOINS CHICAGO-VIT STAFF

The Chicago Vitreous Enamel Product Co., Cicero, Ill., has announced the appointment of F. L. Meacham as manager of sales and service.

Mr. Meacham was formerly research chemist and metallurgical assistant at the American Rolling Mill Co., Middletown, Ohio, during which time he pioneered and developed sheet metal for the application of porcelain enamel. More recently, he has been with the Frigidaire Division of the General Motors Corp., Dayton, Ohio, where he held various offices, the last of which was manager of the War Production Engineering Division in full charge of all engineering problems in connection with the production of war items manufactured by Frigidaire.

Mr. Meacham joined the Sales and Service Division of the Chicago Vitreous Enamel Product Company November 16, 1943.

F. L. Meacham

NECROLOGY

FRANK SCOTT RUSSELL

Frank Scott Russell, chairman of the London & Sheffield Publishing Co., Ltd., London, England (publishers of *Claycraft* and *The Refractories Journal*) died after a long illness September 8, 1943, at the age of sixty-five.

J. E. Roberts, editor of *Claycraft*, has paid fitting tribute to Mr. Russell in an editorial published in the October, 1943, issue of his publication, excerpts from which are given in the following paragraphs.

His Career

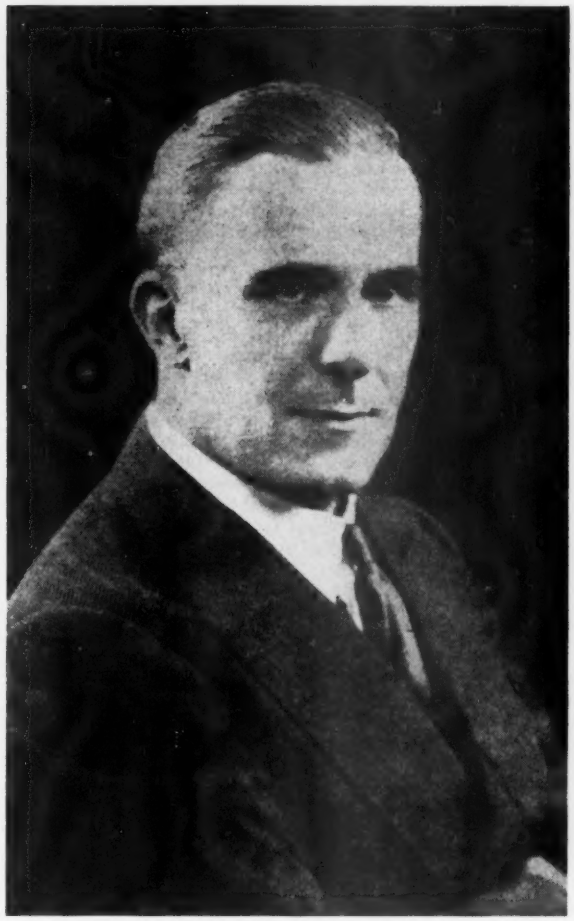
"Frank Scott Russell was born in Hull in 1878 and began his business career with Walker & Hall, Ltd., silversmiths, Sheffield, and later entered the refractories industry by joining J. Grayson Lowood & Co., Ltd., Deepcar, near Sheffield. In 1913, under the name of the Kelham Island Firebrick Co., Ltd., the General Refractories Co., Ltd., was established, Mr. Russell being one of the founders. Later this Company was the principal unit in the amalgamation of a number of companies and became known as General Refractories, Ltd., with Mr. Russell as chairman.

"For many years he resided at Worksop, where he was a member of the Urban District Council before Worksop became a Borough in 1931 and a Trustee of the British Legion, but removed to Forsbacka House, Ranmoor, Sheffield, in 1931.

"In 1935, he bought Ranmoor Hall, Sheffield, where he went to live, and in 1936 the administrative headquarters of General Refractories, Ltd., were removed from Wicker Arches, Sheffield (prior to which they had been at Blonk Street and Kelham Island, Sheffield) to 'Genefax House,' Tapton Park, Ranmoor, the new premises being opened by the Rt. Hon. Lord Riverdale of Sheffield September 17, 1936.

"At the opening ceremony, at which the Lord Mayor and the Lord Bishop were present, Mr. Russell welcomed his old friends, and particularly E. P. Page, who was with the firm at Kelham Island in 1913; in fact, he was there before Mr. Russell himself.

" 'We came to Tapton Park,' said Mr. Russell at the time, 'because we wanted a more fitting house for our activities. We wanted more room and a more suitable headquarters, and, above all, we wanted to do our work in purer air with more sunlight, less noise and dust, and in more healthful surroundings. We wanted to improve the health of our staff, to give the young men a chance to grow up more sturdily, and to deepen the damask on the always rosy cheeks of our lady assistants.



Frank Scott Russell

Kelham Island to Blonk Street

" 'It was in 1913 that we established ourselves in Kelham Island. In those far-gone years we lived laborious days. We were happy in our six rooms, which we still possess. Later, in 1920, we moved to Blonk Street, where we had an extra room. Rapidly outgrowing those premises, our next trek was in 1926 to the Wicker Arches, where in the old offices of the Brightside Foundry Company we had over twenty rooms, and, for a time, there was space enough for our activities.

" 'It was in 1929 that we formed ourselves into a public company.

From Wicker Arches to Ranmoor

" 'The accommodation at Wicker Arches did not, however, suffice, so we moved to Ranmoor, taking the great liberty of changing the name of the premises to Genefax

House. Here we have more than twenty-five rooms, but being still a little cramped, we are arranging for the erection of a wing, which will give us more room, so that perhaps in the end we may be satisfied for a while.

" 'We have done our best to preserve the amenities of Ranmoor and the traditions of its leaf-hidden mansions. We have avoided doing anything to offend the susceptibilities of our neighbors, and hope we have succeeded.'

Visits Abroad

"Mr. Russell traveled extensively abroad, visiting France, Italy, Greece, Turkey, Bulgaria, Serbia, Hungary, Austria, and the Scandinavian countries and America on several occasions, one of his trips being aboard the *Queen Mary*.

"His second daughter, Celia, was married at St. Louis, Mo., in January, 1938.

Air Travel

"We remember him telling us of a comfortable journey by air from Copenhagen to London in $8^1/_2$ hours, as against the 35 hours which would have been occupied by train and steamer, and that he was finally convinced that the future of long-distance passenger transport lay in the air. He was a man who found an 'opportunity' in every circumstance. His visit to the Balkans resulted in the formation of S. A. General Refractories of Greece, with headquarters at Athens, and General Refractories (Yugoslavian) A. D.

"He was the kind of man who would find an opportunity to sell sand even in a desert.

Forty Years in the Industry

"In 1939, Mr. Russell relinquished his chairmanship of General Refractories, Ltd., which position he had held for twenty-five years, and a number of other chairmanships and directorial positions, so that he might be better able to devote more time to the unemployment problem in South Wales, mainly by helping with the establishment of new industries, and to this end he formed South Wales Magnesia, Ltd., and the Forest of Dean Stone Firms, Ltd.

"He removed from Sheffield to Cheltenham in 1940 and lent his Sheffield house, Ranmoor Hall, to the Red Cross for the duration of the war.

"Busy" Men

" 'What are these "busy" men after all,' he used to say, 'but bewildered deluded children, groping in the dark, fearful lest some unknown power should snatch from their shoulders the precious load they carry and which is in any case too heavy for them! They rush here and dash there, go in for this and go in for that, but they never stay in one place long enough to absorb its atmosphere and realise its charm, nor do they stop with any one thing long enough to see below its surface and appreciate that it has a hundred different aspects they have never seen or even dreamed of. They are skaters on the thin ice of Destiny, and they do not know or guess what real life might mean to them.'

"A 'busy' man, such as he was, with a philosophy of this kind, he must have been the despair of many who imagined that his sole aim in life was to make money.

"He may have been acquisitive but he was certainly not miserly. He had a quick and active mind with a comprehensive grasp of detail. He was a man who hated delay and procrastination. Some might have found him impatient. But determination was the servant of his reason. He could not be accused of obstinacy. He could always see more than one aspect to any question of importance, but he had the courage of his convictions and the will to work and to back his own judgment.

"Once he had determined his line of action, his will power, courage, and dogged persistence were such that he would resent interference very fiercely.

Analytical

"Outstanding in his nature was his desire to reason and compare. Adaptable and extremely analytical, he had a splendid memory and speculative nature, although there were times when he exercised a certain amount of imprudence induced by illusory prospects.

"He could never tolerate an untidy mind. I always felt that his habit of trimming the edge of a blotting pad, when he sat at a meeting, or straightening some picture on the wall while continuing to discuss some matter of business revealed more to a student of the mind than many would ever dream of realising. To some, of course, these habits would be aggravating, but there was method in his madness and woe betide the person who imagined that because he fussed about with a blotting pad he was unobservant or liable to miss anything they might say or do. He would certainly have made a very good detective.

" 'Don't kick if I kick,' he used to say. 'If you're worth while correcting, you're worth while keeping. I don't waste time cutting specks out of apples that are rotten.'

"Those who have been able to survive this maxim of his have much for which to be thankful.

The "R. J."

"His aim and desire in launching *The Refractories Journal* in September, 1925, was 'to record the events of the industry, to applaud its successes, to sympathise with its failures, and to record its births, marriages, and deaths, its meetings, outings, and conferences.' A few words, but full of meaning and significance.

Importance of Refractories

"We like his definition of the refractories industry. 'We know full well,' he said 'that there can be not a gun, not a tank, not a ship, not a shot, not a shell—nay, not even a needle for a bandage—without refractories. . . .'

Published Works

"He wrote several technical papers which were published from time to time. These included 'American Experiences' (1926), 'A Route Rich in Refractories' (U.S.A., 1926), 'The Lining of a Cupola' (1927), 'Refractories and Their Uses' (1930), 'Refractories—An Outline of the Industry' (1932), 'Refractories, Refractorers, and the Non-Ferrous Metal Industry' (1933), 'Electrical Furnace Refractories' (1933), 'Refractories in the Foundry' (1934), and 'The De-Airing of Clays' (1934).

"He was also instrumental in founding *Claycraft* (the official organ of the National Association of Clayworks Managers) and *Cement, Lime & Gravel* (which incorporates *The British Limemaster*). He was also chairman of *The British Steelmaker*, Ltd., and founder of *The British Steelmaker*. He was Honorable Secretary of the Sheffield Ganister and Compo Associations and founder of the Limemasters' Association. He was a Fellow of the Geological Society, the Royal Society of Arts, and of the Entomological Society. He was chairman of Sherwood Trust, Ltd., and *Quarry Managers' Journal*, Ltd., Russell House (Adelphi), Ltd., and the Adelphi Guild, and on the board of numerous other companies.

Genius for Friendship

"He certainly had a genius for friendship. As is well known, he was instrumental in founding the Refractories Association of Great Britain and the National Association of Clayworks Managers. He was a past-president of both associations and also of the Institute of Quarrying and the Yorkshire Firebrick Association.

"He was also a member of numerous other associations including the Iron and Steel Institute, the Institute of Metals, and the Institute of British Foundrymen. Even on the Home Guard he had his views: 'They unexpectedly discovered themselves to be the finest antidote to worry,' he said, 'and the happiest social organisation that has ever been conceived.'

Lancastria Club

"We also have the Lancastria Club, of which he was president. It comprised the leading lights of the foundry industry, including people of French, Belgian, German, Dutch, and Italian nationality, an international group of foundrymen who were, because of the tempestuous weather, literally thrown together for ten days when crossing the Atlantic in the *Lancastria* to attend the Detroit International Congress in 1926. He presided over the Annual Banquet of the Club in Paris in 1937."

ECKARDT V. ESKESEN

Eckardt V. Eskesen, a Fellow of The American Ceramic Society and president of The Society in 1931–1932, died December 17, 1943.

Mr. Eskesen had been actively engaged in the terra-cotta industry for more than forty years and at the time of his death was president of the Federal Seaboard Terra Cotta Corp., New York, N. Y.

A biographical sketch of Mr. Eskesen was published in *Bull. Amer. Ceram. Soc.*, **16** [10] 412–13 (1937) and his photograph appeared on the front cover of the same issue.

SAMUEL GEIJSBEEK

Word has been received of the death of Samuel Geijsbeek, a charter life member and Fellow of The American Ceramic Society and vice-president of The Society in 1906–1907.

Mr. Geijsbeek died December 6, 1943, following an emergency operation which took place while he was visiting his sister in Laguna Beach, Calif. He made his home in Kent, Wash.

Funeral services for Mr. Geijsbeek, who had celebrated his seventy-third birthday August 11, were held in Santa Ana, Calif. Memorial services were held December 18 in Seattle, Wash.

OPEN LETTER FROM HEWITT WILSON TO THE CHAIRMAN OF THE WHITE WARES DIVISION COMMITTEE ON RESEARCH*

Ralston Russell, Jr.,
Chairman, Committee on Research,
White Wares Division,
The American Ceramic Society

Dear Dr. Russell:

I was glad to receive the "Record of Symposium II: Testing and Classification of Ball Clays," particularly as I was unable to attend the meeting in Pittsburgh last spring.[1]

This is a mighty good start on a mighty big job. Naturally, the beginning discussions include some turmoil of ideas and confusion of thought until focused on a few main objectives, especially when the participants are all clay testers and each considers himself to be an authority on the subject. That, of course, includes the present writer.

It was well that the confusion of the purposes in view, as expressed in the introduction, was clarified and the objectives were simplified in the conclusion. I am in complete accord with the initial simplified program to develop standardized methods of testing ball clay for (1) water of plasticity, (2) drying shrinkage, and (3) dry strength. There is enough hard labor in this portion of the program for one laboratory alone, and the difficulty is multiplied almost by the number of operators who will try to correlate their results. The correlation of these "simples" with the so-called fundamental properties of ball clays is a more difficult scientific problem. As water of plasticity is a manufacturing variable of molding pressure (soft plastic, stiff plastic, and dry press) and drying shrinkage varies with the water added for molding, these two properties do not give a true criterion of the nature of the individual clay. A better but still imperfect correlation was found between the dry pore space (pore water) and the dry strength.

At least two methods can be used for conducting the test development work. In the first method, a group of willing participants receives all the duplicate samples and tries all the tests, which have been tentatively proposed from the basis of past experience. This is applicable to tests that require no specialized equipment or equipment that can be purchased quickly on the open market. The variable data are compared, the poor procedures remedied, and retrials made until a reasonable correlation is found.

In the second method, each of the separate problems is assigned to a particular laboratory or man having a special training, special equipment, or a special interest in that particular problem. With or without check tests by other members, the original recommendations are approved or changes made and the retrials are completed.

A combination of both methods is necessary for this complicated program. The three initial tests—water of plasticity, shrinkage, and dry strength—can be brought with perseverance to the semifinal test procedures by the first method, but soluble salt, accurate particle sizing, mineralogical differential thermal analysis, etc., can be done only by a more limited group. The second method will be necessary also to develop the most accurate procedures for such common properties as shrinkage and porosity, similar to the work of E. W. Washburn in 1921 and 1922. I believe that a new and more accurate method is necessary for determining the porosity of dry clay than that adopted in the 1928 standards.[2] New tests will be needed to explain the unsatisfactory commercial behavior of certain ball clays which are reported to have test results similar to those of the satisfactory clays.

We propose to extract the romance from one of the most complex physical, chemical, and mineralogical agglomerations on the earth's surface. The ball clays of the lower Mississippi basin present an unusually perplexing problem as, in a narrow band about 200 miles long, are found kaolins derived and transported from the granitic rocks of the East (and West), ball clays derived from the kaolins, and bentonitic clays derived from volcanic dust from the West. Their mixtures present complex mineralogical and physical properties. Across the Mississippi in Texas are the white-firing bentonites, which should in the future have considerable importance for the ceramist, as enormous strengths can be produced with a minimum weight addition without the loss of color value. Any standard test methods that we prepare must cover a wide range of physical properties, and we shall need the help of mineralogists and of physical chemists with a very special training to correlate the ceramic tests with the fundamental properties.

Testing of Kaolin: An overlapping of the properties of kaolins and ball clays is the natural result of the continuation of geologic history from the former to the latter. Both are used by manufacturers of whiteware. It is therefore only a question of time until a similar series of tests will be applied to kaolins. Time and energy can thus be saved by making the series of tests for ball clays suitable for the kaolins. Several factors will bear watching, viz., the weakness of kaolins in the dry state, their low bonding power, and their peculiar cubical cracking and tenderness during drying and firing.

Because of the complexity of the problems involved in the program, it is apparent that several subcommittees should be appointed for a review of past work, for preparation of the detailed program ahead, and for the prosecution of the correlative tests.

Subcommittee on the Review of Literature: We are not starting an unknown problem, and the past efforts have not all been in vain. This committee can correlate the numerous published and unpublished data applicable to ball clays, summarize the progress that has been made, and give us a clear-cut statement of each remaining technical and commercial problem.

Subcommittee on Test Equipment: If we are to develop a correlation of technical value between the three physical properties selected for study and the fundamental nature of ball clays, our work must be done accurately, or at least as accurately as it is now done for the materials of competing products. We should eliminate hand-working and the other operations with personal variables to produce pre-

* Received in Society offices November 15, 1943.

[1] For outline of Symposium, see *Bull. Amer. Ceram. Soc.*, **22** [4] 106–107 (1943).

[2] See *Jour. Amer. Ceram. Soc.*, **11** [6] 448–57 (1928).

cise data and use, or modify for use, the best equipment known to man at this time. An industry with an annual production of over $100,000,000 should not haggle over a few hundred dollars' worth of equipment necessary to secure reproducible results in the testing of an important raw material. The progress of this research program should not be handicapped by the reluctance or inability of some manufacturers to purchase adequate testing equipment. Chemists buy expensive balances with definite well-established degrees of accuracy for chemical analysis, Portland cement laboratories have Wagner turbidimeters, and electrical insulator manufacturers have expensive electrical testing equipment. Even if this country could afford but a single machine or combination of machines which was approved as a standard for all other machines or methods, it would be a worth-while investment for the sake of standardization and control. The case would be similar to the standard weights at the National Bureau of Standards or the use of the comparatively few recording spectrophotometers in the country for color standardization.

Another subcommittee should therefore be appointed to study equipment from all sources: physics, agriculture, civil engineering tests of soils, mechanical engineering, metallurgy, ore dressing, electronics, the machines used for testing cements, limes, and plasters and those used for molding small shapes of steatite and plastics.

Classification of Ball Clays

If precise and complete data are secured on this or any other subject, it is human nature to reduce these data to some type of classification. It cannot be prevented and therefore the committee should protect itself by an organized study of various methods of classification as part of the planned program. Numerous classifications can be made according to pertinent variables without referring to specific uses. The manufacturer who knows his plant problems and requirements can make his own selection from the test data. It is only a matter of time, however, after the test data have been assembled, until ball clays will be classified in the trade according to uses.

Mine vs. Plant Selection

We should not try to kill too many birds with one stone. Too many refinements should not be added to the selection of samples when the main purpose at the start is to develop test methods. To start this development, only a few samples, representing different types, should be sent to all those willing to enter this school of ball-clay testing. But it is important that identical samples be sent to the different laboratories. They should be ground to such a particle size that each sample can be divided and subdivided on arrival without causing variation in composition and water content, except by gross carelessness; that means dried to such a condition that the only variation will be from atmospheric changes. These are minor in a warm laboratory for the raw material. The simplest way, therefore, to start the testing procedures would be to use the air-floated clay. Enough other variables will be introduced by individual handling of the samples to cause plenty of trouble. Shredded samples with a larger chunk-size will offer just that much more error for manipulation, and the variations in water content will complicate the situation. After the standard tests are approved and the different laboratories are reporting consistent results, questions about the condition of clays for shipment and sampling can be settled. This seems to be a case of individual preference similar to the individual preferences for different body compositions or methods of molding.

An immediate solution of the testing-procedure problem is not necessary, as enough data are available to answer the ball-clay problems for the war. But if the important initial idea is to select or develop methods for water of plasticity, shrinkage, and strength, the program should not be complicated by an extended, simultaneous study of the different ball clays throughout the United States. Three clays representing the toughest, the medium, and the weakest strength will be sufficient in the development stage.

Identity of Samples: Sidney Speil suggests that samples be selected by lot for the preliminary tests. A blind selection, as draft numbers were drawn for the Selective Service, can be made from all the available and representative ball clays of each type (plastic, medium, and weak).

A second suggestion which, however, involves more difficulties in the preparation of the samples, is to select representatives from each type and ship each group to one producer's mill for grinding and thorough mixing. The producers could divide this work among themselves and make their own selections.

Standard Compositions

As a member of the 1928 Committee on Standards, let me call to your attention that the methods adopted for clays, in general, required the use of 100% clay with two exceptions: (1) for dry, transverse strength, where an equal weight of standard 20- to 30-mesh silica sand was used, and (2) for the slaking test, where a 50-to-50 mixture was made of clay and potter's flint. The coarse sand produces a body that is totally unsuited for firing tests. Potter's flint gives a good working mixture and 40 to 60% flint is necessary for most ball clays to avoid warping and cracking. In the report on clay tests in 1942, the Bureau of Mines' Norris laboratory found that 60% flint gave better strength correlation with all ball clays than did 50% because, with many of the high-shrinking clays, the cracking difficulties were not removed with 50% flint, and 60% gave more uniform and consistent values.

These same results indicated that the flint should be as nearly pure silica as possible and that those which contain feldspar should be eliminated, not because they are not good pottery materials and give feldspar for the price of flint, but that such mixtures introduce one more variable, and uncontrolled variables are the factors that can swamp this program.

Without doubt the standard flint should be standardized by composition, particle shape, and size down to the finest particles that can be accurately determined with the best equipment. Angular grains produced by grinding quartz should be satisfactory, as the angularity is uniform and this material is the common type used by the manufacturers in this country. A stock pile of standard flint is best for uniformity.

Preliminary tests have shown that a noticeable particle packing occurred even with particles as fine as those in clay and flint, because the flint is much coarser than the finely divided ball-clay particles. Some care should therefore be taken in selecting the flint.

The committee will have enough to do for five years to obtain accurate data on a few simple tests with flint alone and not get into the difficulties of body mixtures if a large number of laboratories are involved in correlative testing. Chemical properties, mineral properties, particle-size distribution, and other fundamental "cause" properties must, of course, be determined on 100% clay.

We should make these ball-clay tests as precisely as possible, using suggestions from tests of other materials. The drawing of specifications for ball-clay classes is another matter. They can be liberal enough to meet the producers' difficulties, but the methods of testing should be taken out of the "mud" state and put upon as near a scientific and technical basis as we can devise. And this includes the matter of the best equipment.

Plastic Process: Batch Preparation, Slurry Dewatering vs. Dry-Mixing Methods

The dry-mixing method was "dropped like a hot potato." May I offer some defense: When a member stated that dry mixing was unsuitable for our purpose because of the large particles of lignite and other impurities, he was not speaking for the entire whiteware industry, which includes the small but growing "dry" method for plastic molded bodies that are not washed free of impurities but are prepared direct by grinding and tempering mixers. Ball clays are used in some of these. Dry-press bodies include ball clays.

Also, should not these tests be made upon ball clays as delivered and not as refined in the manufacturer's plant? The least that could be done to cover the complete testing would be to determine and record the amount of impurities removed by a 100-mesh screen. The amount of soluble salts in the original condition is also of some value. The dry method should be adopted at least as an alternate method.

Many difficulties are eliminated by using dry preparation, including blunging, dewatering, soluble salts from plaster bats, and reducing the water content for the proper consistency, which cannot be done accurately without several weight-control determinations.

A number of ball clays resist dewatering with the greatest tenacity. With an equal portion of flint, however, the dewatering difficulty is largely decreased. The six pages of tangled discussion illustrate the troubles that will be encountered in attempting to standardize the slurry-dewatering procedure.

But sooner or later this must be done for tests of clays in the washed condition, so we might as well prepare for it. The discussion brought out the inability to control the water content of clay dewatered on plaster bats, in canvas sacks, and other slow laborious and rather ineffective methods, although small table, iron filter presses can be purchased from the chemical apparatus dealers for $80 or brass ones for $115 (before the war). These can be equipped with an air-pressure tank of slip and pressed to a constant pressure.

The dry or unwashed preparation system leads to a simple method of water control, as definite additions of water are made to clay-flint mixtures and no water needs to be withdrawn. If a mechanical pugging or damp grinding device can be agreed upon, the time of tempering and aging can be controlled accurately and uniformly in different laboratories. If the personal element is not greatly reduced, little has been gained. The discussion at the 1943 symposium clearly substantiates this fact.

Control of Water Content: Three factors are involved in regulating the water content: (1) It is desirable to determine the optimum content for an uncracked structure of the highest strength, (2) each operator should be able to determine and use this optimum, and (3) the adopted method should parallel or be as close as possible in principle of operation to that used in molding the test specimens.

Both dry strength and shrinkage vary, at least in some cases, over certain ranges of water content. Research is needed to determine the broadness of the water-content range in which the strength is not affected. The past difficulties may have been caused by variations of water on the edge of the safe working range and not in the middle. Apparently, the human hand and some machines are unable to detect these variations for different clays, although they are satisfactory for detecting the variations in the same clay or same body day after day in the shop.

For the sake of uniformity among operators, the median between the workable extremes should be studied, on the perhaps unwarranted assumption that it will lie in the range of optimum workability. Most operators may be able to find the median more precisely through the extremes than by a direct attack. A stabilized modification of the Atterberg plasticity method, whereby the driest and wettest workable conditions are determined, may be safer, as their median therefore would avoid the edges of workability where the strength changes rapidly.

This procedure involves the determination of two conditions rather than one. Determination of the best median for 100% ball clay may not correspond to that for a mixture of ball clay and flint. The adopted method should be correlated with the molding machine and this machine itself can be used for the test, although it does not eliminate the judgment of different persons and requires more clay than other methods. Some experience with the vacuum auger machine indicated that the water range of workability was more limited than that determined by the Atterberg method.

Vacuum Equipment

I am fully sold on the vacuum extrusion machine for molding bars, preceded by a mechanical device for pugging. I do not believe that the vacuum treatment is necessary for the original tempering or wedging but do not object if it can make a more nearly perfect sample. Expensive mechanical equipment is used for such materials as molding sands, both for preparing the test specimens and their testing.

Plastic Extrusion

Having worked with vacuum auger-forming machines, I do not entertain the fears voiced by E. H. Fischer. The machine at Norris was a great timesaver, and without it we could not have secured an effective degree of uniformity. Vacuum machines can be made simply and cheaply, and one of them can be selected as the standard machine for adoption. The augers can be standardized, as well as the dies, taper, and the distance of the die from the auger end. Wear will change these in time, but the maintenance of equipment in good condition is always one of the duties of the operator.

The use of a grid in the auger machine will straighten the auger twists. Increasing the distance of the end of the auger from the back of the die is another aid. It is not difficult to obtain a good working column from a 50–50 or a 40-clay–60-flint mixture. I would go farther and say that, if a good column could not be produced in small auger machines, it could not be done in the piston machine described by Mr. Fischer. I used a short piston machine for making samples for over four years as a control,[3] but never one 10 ft. long. The machining of such a cylinder, its carriage, and power-driving mechanism must raise the cost to something similar to that of an auger machine made in quantity lots. We want a machine that will handle small quantities, such as 5 pounds as a minimum and more without recharging. The greater the charge in the piston machine, the more power is required. The auger machine gives a continuous feed and discharge for a small or large quantity. And many specimens are required for a complete set of tests.

One of the worst types of lamination is caused by the die, and this is common to both the auger and piston machine. Differential shrinkage is not eliminated in the piston machine. This is the common type used in extruding electrical insulator shapes, and differential shrinkage is one of the worst problems of this industry.

I would not condemn a type of equipment as common as the auger machine without a thorough study of the pros and cons. It should be referred to a subcommittee on equipment.

Drying Procedure

The elimination of the 5-hr. drying period at 64° to 76°C. passed by the 1928 Standards Committee[2] must be explained. Many clays cannot stand the rapid change from room temperature to 110°. The purpose of a standard procedure in drying is mainly to produce uncracked bars, and with ball clays, especially, this is a very difficult job. Again, the 60% flint produces a better all-around and safer drying body than one with 50% flint.

"Air drying for two days" is rather indefinite. Some clay-flint mixtures require delicate handling, such as covering for several days of seasoning or a humidity treatment before being permitted to dry slowly. Turning is also essential in particular cases. We can set up a schedule that will be satisfactory for 90% of the clays but not for the remaining 10%. The criterion in drying should be the production of test bars showing no cracking planes after dry-breaking and a definite consistency of transverse-strength data. The strength test is the most sensitive of all. Drying will require special individual attention in many cases and even repeat trials to produce perfectly dried bars. I do not believe that a clay should be eliminated from the satisfactory ball-clay group if it should crack under a specified but general drying procedure, but

[3] R. F. MacMichael, "Testing of Clay," *Trans. Amer. Ceram. Soc.*, **17**, 639–59 (1915); p. 643.

that it should either be given a special drying treatment or more flint should be added. In other words, it may be necessary to assign a different flint content to each of several groups of ball clays and obtain direct correlations only between the members of the respective groups. It should be remembered that only in extreme cases are ball clays used in amounts as high as 40 or 50%. The use of the minimum amount of ball clay is the usual procedure in whiteware because of color and shrinkage. The ball clay should not be penalized if 2% will do the work of 15%.

Drying Shrinkage

The drying shrinkage should be retained for these tests as a per cent of the dry condition. A change would increase the confusion and conflict with published data. Drying-shrinkage data would have less technical value in these standardized tests if the basis of calculation were placed on the more variable rather than on the more stable condition. The dry state, however, is not completely stable. Even the usual volume determinations show a variation in dry volume and pore space with water-of-plasticity changes. But it is the best we have.

Linear vs. Volume Shrinkage

I favor dropping the single longitudinal linear shrinkage determination except for rough work and propose that for the standard tests linear shrinkage be calculated from volume shrinkage. The two independent measurements are not correlative, and a choice must be made between them for the position as standard. Is there any question about volume-shrinkage measurements being the more representative?

Miscellaneous

Student Help: It is not a question of outlawing students or any other group but rather a question of training persons for the job and not using their data until they have qualified by being able to check their own results and those of trained operators. The case is similar to a chemist checking his analytical work with the standard samples obtained from the National Bureau of Standards. Standards of performance should be established for qualified operators.

Ten thousand parts of water for one part of calcium sulfate or gypsum is not the correct solubility.

Acknowledgment

Credit is given to Sidney Speil for criticizing these notes, with many of which he does not concur.

Electrotechnical Laboratory
Bureau of Mines
Norris, Tennessee

WARNING NOTE SOUNDED ON NATIONAL FINANCES

Speaking before the American Institute of Chemical Engineers at their thirty-sixth annual meeting held November 15 and 16, 1943, in Pittsburgh, Pa., H. W. Prentiss, Jr., president of the Armstrong Cork Co., Zelienople, Pa., and past-president of the National Association of Manufacturers, sounded a warning note on the financial status of the United States. His address is summarized as follows:

With a public debt of from 250 to 300 billion dollars at the end of the war, the nation will be treading on perilous financial ground.

The banks of the United States now own approximately 70 billion dollars' worth of Government securities—approximately 40% of all Government issues outstanding. The Government must maintain, through purchases of its own securities, the market value of its outstanding obligations. A drop of ten points in the value of Government bonds would bankrupt practically every banking institution in the country.

It seems likely that the day when the average individual starting from scratch can accumulate any substantial financial competency for his old age, or for his family when he dies, is past. This is a matter of grave moment, as it strikes at the very root of the incentive system that has had so much to do with the economic development of America in days gone by.

Fourteen years ago, a middle-class family of husband, wife, and two children, with an income of $5000 a year, paid a Federal income tax of $3 a year. If the new rates proposed recently by Mr. Morgenthau were put into effect, the family would have to pay $1163 in Federal income taxes, which would absorb all of the $1200 or $1500 that was formerly saved.

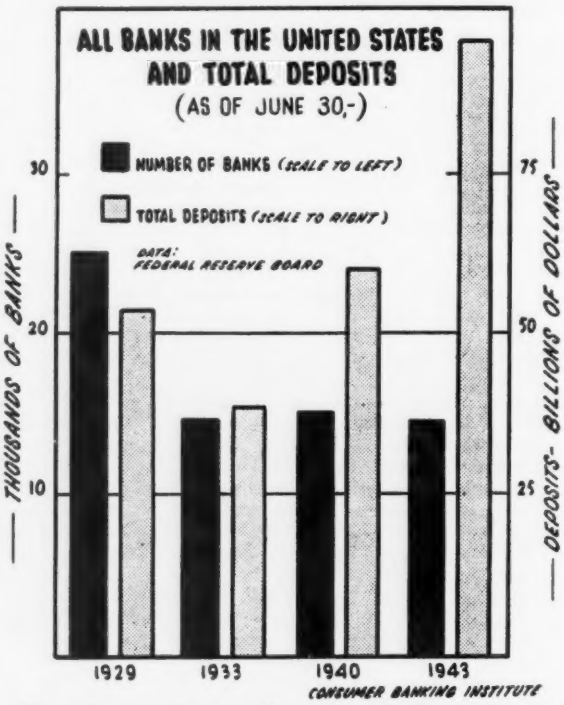


Chart showing the mortality among banks in the past fourteen years, although deposits are about 79% above the 1929 level.

War production in 1944 is expected to reach the astronomical figure of 80 billion dollars, or more than 70% of the nation's industrial output. The construction cost of the Panama Canal was less than 400 million dollars, so during 1944 the production of munitions will be equivalent to the building of more than 200 Panama Canals, or a little better than one canal every two days.

The Government has acquired 47,000 square miles of land during the war, an area approximately that of all the six New England states. At the end of the war, the Government will own more than 50% of the country's annual capacity of aluminum, 92% of the magnesium capacity, 10% of steel, nearly 100% of synthetic rubber and high octane gasoline, 50% of machine tools, and at least 90% of aircraft.

PROPOSED AMERICAN STANDARD BASIS FOR THE COORDINATION OF DIMENSIONS OF BUILDING MATERIALS AND EQUIPMENT—A62.1

(Continued from the December, 1943, *Bulletin*, pp. 417–18)

Organization of ASA Project A62

To make possible such a cooperative industry approach to the problem, the American Standards Association, in September, 1938, held a well-attended conference of producers and users of building materials to consider a pro-

posal submitted to the ASA by Alan C. Bemis, whose father, Albert Farwell Bemis, had been well known for his interest and research in support of the promotion of dimensional coordination and the establishment of coordinated dimensional standards for building materials.

It was proposed that the American Standards Association, through its sectional committee procedure, undertake the development of coordinated dimensional standards for materials and construction. To facilitate such an industry program, financial support would be made available for the technical and secretarial services of the Modular Service Association, an organization for research in the field of modular standards.

This proposal pointed the way to the first comprehensive study of the problems of coordination on an industry-wide basis. The conference unanimously recommended to the American Standards Association that a project on dimensional coordination for development by the ASA sectional committee procedure be established and that the American Institute of Architects and the Producers' Council, Inc., be invited to serve as joint sponsors for the project.

The American Standards Association acted favorably on the recommendations of the conference and ASA Project A62 was initiated, early in 1939, with the American Institute of Architects and the Producers' Council, Inc., as joint sponsors.

As authorized by the American Standards Association, Project A62 comprehended the study and development of dimensional coordination as the solution of a basic problem, with no commitment to adopt or follow any preconceived method or solution.

A sectional committee was organized composed of representatives of various branches of the producing industry, architectural and engineering societies, Government agencies, and others interested in the use of building materials.

Scope of ASA Project A62

ASA Project A62 has proceeded under the following Scope:

(*a*) The development of a *basis* for the Coordination of Dimensions of Building Materials and Equipment and the Correlation of Building Plans and Details with such dimensions.

(*b*) Recommendation of sizes and dimensions as Standards suitable for dimensional correlation.

Basis of Dimensional Coordination

As the result of the comprehensive studies of the subject previously made by Albert Farwell Bemis and others, ASA Sectional Committee A62, in 1939, tentatively adopted a four-inch layout unit or module as the basis for coordination most consistent with present building practice and affording the maximum simplification compatible with practicable flexibility and utility and took steps to test its applicability to building materials generally.

Definitions of the terms referring to the application of the principles of dimensional coordination form a part of the Basic Standard.

Application of the Basis of Coordination to Building Product Dimensions

To determine the applicability of the principles of dimensional coordination to particular materials and products, the Sectional Committee organized specialized study by the following working subcommittees:

(1) Masonry Made of Structural Clay Products
(2) Wood Doors and Windows
(3) Masonry Made of Concrete and Cast Stone
(4) Metal Windows
(5) Natural Stones, including Granite, Limestone, and Marble
(6) Structural Wood
(7) Building Layout
(8) Structural Steel
(9) Miscellaneous Metal Products

The several subcommittees have made gratifying progress in demonstrating the practicability of applying the principles of dimensional coordination to the important elements of building construction and confirm the four-inch module as the size of unit most consistent with present building practice and affording the maximum simplification compatible with practicable flexibility and utility.

It is recognized that a limited number of materials and items of equipment, because of their particular character and use, do not lend themselves to the application of dimensional coordination with the economies and advantages applicable to structural and other materials and items of equipment, generally.

The Executive Committee of Project A62 is satisfied that, with the exceptions previously noted, the principles of dimensional coordination are applicable to building materials and equipment, generally.

The studies made by the various subcommittees will lead without delay to the submission for adoption of Application Standards for certain of the materials studied. These will be followed by further Application Standards as studies by special groups under the supervision and with the assistance of Sectional Committee A62 are made of other materials and products.

These Application Standards will provide the manufacturers of particular materials and products with modular product sizes applicable to these materials and products.

Fortunately, many of these sizes may be put into production as industry retools for the postwar era.

As an illustration, the American Standard for the Coordination of Dimensions, as applied to masonry made of structural clay products, will call for the development of an application standard to establish modular product sizes for various types of structural clay products customarily employed, either individually or in combination, in construction; to the end that when used, either as individual types or a combination of several types of unit, and particularly when in conjunction with other coordinated materials and equipment, the cutting and fitting of individual parts would be reduced to a minimum and, as far as practicable, eliminated.

Correlation of Building Plans and Details with Dimensional Coordination

Acceptance by designers is the first prerequisite to adoption of coordination. The various study committees have proceeded to the point where it can be said generally that it is feasible to correlate building plans and details through the proposed Basic Standard as well as fix standard coordinated sizes and dimensions of building materials and equipment. Study Committee 7 on Building Layout is determining the methods through which building plans and details may be so correlated. The information which this Committee will issue will adequately inform the designer and indicate that preparation of building plans and details under this project is practical, and not complicated.

Furthermore, this Study Committee is testing the correlation of building plans and details through the application of coordinated or modular design to specific projects now being planned for postwar construction. As this work would involve the use of modular masonry, the question was raised whether brick and structural tile of standard coordinated dimensions would be available. An inquiry addressed to the manufacturers resulted in the assurance that such products could and would be furnished if desired.

Advantages of Coordination

The advantages of the dimensional coordination of building materials and equipment apply to (1) the preparation of the building plans and assembly details, (2) the manufacture of materials and equipment, and (3) the site fabrication of the same into the complete building.

(1) The coordination of the dimensions of building materials and equipment does not contemplate the standardization of building design.

As a matter of fact, the coordinated dimensions of component parts will provide complete flexibility in planning the building layout and a variety of dimensioned parts and equipment, available in "Stock Sizes," adequate to meet the requirements of utility and ap-

pearance. Furthermore, the preparation of detail drawings will be expedited.

(2) Dimensional coordination of individual parts will eliminate unnecessary intermediate dimensions in determining the number of "Stock Sizes" for individual materials and items of equipment while it will encourage the use of a limited, but adequate, number of stock sizes, thus reducing the cost of special details, custom manufacturing, and the maintenance of slow-moving stocks of an unnecessary variety of materials and equipment serving similar uses.

(3) The application of dimensional coordination to such materials as preformed clay and concrete products and doors and windows will avoid the cutting and fitting usually required in wall construction where these materials are used.

Dimensional coordination of materials does not preclude the use of conventional methods of cutting and fitting, if, for any reason, the requirements of design call for materials to which the principles of dimensional coordination have not been applied.

It will be obvious that the more completely the principles of dimensional coordination are applied to the component parts of structures as a whole, the greater will be the advantages resulting from simplification in detailing and manufacture, speed in erection, and reduction in the cost of construction. To insure the maximum degree of these advantages, the Scope of ASA Project A62 includes the coordination of building plans and details with the coordination of building materials.

This contemplates a basis of coordination applicable to all building materials whose physical properties permit a predetermination of dimensions and to many items of equipment built into or permanently fitted to the building structure.*

Outline of Proposed American Standard Basis for the Coordination of Dimensions of Building Materials and Equipment—A62.1

Section 1. Scope

This standard covers the following:

(*a*) The basis for the coordination of dimensions of building materials and equipment.

(*b*) The basis for the correlation of building plans with such dimensions.

(*c*) The basis for the correlation of assembly details with such plans.

(*d*) The method for the establishment of standard coordinated sizes and dimensions of building materials and equipment.

Section 2. Definitions

For the purposes of this standard the following words, terms, and phrases shall have the meaning indicated in this section.

Dimension: Linear measure, such as length, width, or thickness.

Size: A volume measure which may be expressed as the product of three dimensions or an area measure which is expressed as the product of two dimensions.

Building Part: A piece or unit of building material or an item of building equipment.

Detail: A drawing showing the dimensions for a particular building part or assembly of parts.

Assembly Detail: A drawing showing the details and method of joining or combining building parts, either a construction detail which shows assembly of structural parts or materials, or an installation detail which shows the method of installing building parts such as doors, windows, and building equipment.

Dimensional Coordination: A relationship between the sizes and dimensions of building parts that will permit their assembly during field erection with a minimum of cutting or alteration.

Correlation of Building Plans: The layout of buildings with dimensions that are consistent with the coordinated sizes and dimensions of building parts.

Correlation of Assembly Details: Assembly details for coordinated sizes and dimensions of building parts that are consistent with the dimensions of correlated building plans.

Dimensional Increment: The amount of increase or decrease in any one dimension of a building part or of the building.

Standard Module: A unit of four inches used as a standard dimensional increment and as spacing in the standard modular grid.

Standard Grid: A single system of rectangular three-dimensional coordinates to which all building dimensions and details are referred. The grid spacing is the standard module (four inches).

Modular Detail: An assembly detail referenced and dimensioned to the standard grid.

Modular Plan: The layout of a building in plan, elevation, and section referenced to the standard grid.

Grid Line: A line of the standard grid.

Grid Dimensions: A dimension between parallel grid lines on a modular plan or modular detail.

Standard Modular Products: Building parts, the sizes and dimensions of which are established by application standards.

Application Standard: A standard which conforms to and supplements the American Standard Basis for the Coordination of Dimensions of Building Materials and Equipment and which establishes coordinated dimensions and sizes for standard modular products or methods for using standard modular products.

Section 3. Basis for Coordination

The basis for dimensional coordination shall be the standard module of four inches.

Section 4. Basis for the Correlation of Building Plans

(*a*) The basis for the correlation of building plans shall be modular plans referenced to the standard grid.

(*b*) The reference of modular plans to the standard grid shall provide complete four-inch flexibility for the layout of building structure, and shall apply the standard module to the dimensions of the building structure as a dimensional increment. This flexibility of layout and dimensional increment shall apply to room sizes and heights, the sizes and locations of openings in the structure, but not dimensions such as wall and floor thicknesses which shall be determined by economy in the use of materials.

Section 5. Basis for Correlation of Assembly Details

(*a*) The basis for the correlation of assembly details shall be modular details, referenced and dimensioned to the standard grid.

(*b*) Modular details shall establish the amounts by which grid dimensions on modular plans differ from actual building dimensions.

(*c*) The grid lines to which modular plans are dimensioned shall be clearly indicated on modular details.

(*d*) Modular construction details shall conform to the four-inch flexibility of building layout by applying the standard module as a dimensional increment to building dimensions.

(*e*) Modular details, including construction details and installation details, shall conform to recognized architectural and construction practice.

Section 6. Standard Modular Products

(*a*) Building materials and equipment of standard coordinated sizes and dimensions shall be known as "Standard Modular Products."

(*b*) Sizes and dimensions of Standard Modular Products shall be determined by modular details which conform to Section 5 hereof.

* Further information concerning the application of the principles of dimensional coordination will be found in the illustrated 62-page brochure issued by the Executive Committee of ASA Project A62 and obtainable from M. W. Adams, Secretary, ASA Committee A62 (address given in December issue), $1.00 per copy, postpaid.

(*c*) For structural Standard Modular Products, dimensions shall provide four-inch flexibility for building layout as required by Section 4(*b*) hereof.

(*d*) For nonstructural Standard Modular Products, such as doors, windows, and equipment, which are required in a variety or range of sizes, dimensions shall vary by the standard module (four inches) or by multiples of the standard module.

Section 7. Application Standards

(*a*) Application standards shall establish standard coordinated sizes and dimensions of building products or methods for using such products. The procedure for proposing application standards for approval as American Standards shall be as established by the Sectional Committee.

NOTE: Procedures established by the Sectional Committee conform with customary ASA procedures and methods.

(*b*) Application standards which establish sizes and dimensions shall be accompanied by modular details which provide evidence of satisfactory coordination.

Section 8. Approved Modular Details*

Modular details accompanying a proposed standard or other modular details submitted to the sectional committee may be approved by the committee as "Approved Modular Details" and made available to the industry.

* See "Modular Size of Clay-Products Units" by Harry C. Plummer and E. F. Wanner published in *Jour. Amer. Ceram. Soc.*, **26** [9] 307–20 (1943).

TEST METHODS FOR THE EVALUATION OF HOT-WATER TANK ENAMELS

The following discussions were presented during the Symposium on "Test Methods for the Evaluation of Hot-Water Tank Enamels" presented April 23, 1942, before the Enamel Division during the Forty-Fourth Annual Meeting in Cincinnati, Ohio. The paper by W. W. Higgins entitled "Accelerated Corrosion Tests for Determining the Suitability of Enamel for Hot-Water Service," which preceded these discussions, may be published at a later date.

Discussion by G. H. McIntyre and D. R. Goetchius*

The selection of a suitable test in the laboratory for the proper evaluation of the quality of a material or product under actual service conditions is one of the most difficult problems to be solved. This is particularly true in the selection of enamels for porcelain enameled hot-water tanks. Accelerated tests are desired, but such tests must give accurate data as to the performance of the enamel over a period of years under actual service conditions. The problem is so new that no data are yet available to correlate these laboratory tests with actual service.

The object of this discussion is to point out the advantages and disadvantages of certain laboratory tests which have been used in this laboratory in an endeavor to select and develop enamels specifically for the service conditions required in hot-water tanks.

(1) Autoclave Test (preliminary)

Early in the investigation, crude autoclave experiments were made. The autoclave consisted of a large cylinder which could be heated to an undetermined temperature and pressure. The degree of attack was judged by visual inspection. The results were dubious, and this test was discontinued after a short time.

(2) Soxhlet Extraction of Enameled Surfaces

The apparatus for this test consisted of the conventional Soxhlet extractor with distilled water as the solvent. The enameled test piece is placed in the extraction chamber while the temperature of the water is maintained between 160° and 180°F. Preliminary experiments were run on flat enameled samples for 20 hours. Visual examination was made, and results were compared with similar samples boiled in distilled water for the same length of time. The Soxhlet treatment severely etched the enamel surfaces, whereas the same enamels showed no loss of gloss in boiling water. This difference may be attributed to the oxidation which takes place in the Soxhlet extractor, but it is probably due to the build-up of salts from the enamel in the boiling-water test. Thus a decreased effect would result as compared to the continued washing taking place in the Soxhlet extractor.

Weight losses were then made on enameled cylinders, $1^1/_4$-in. in diameter and $2^1/_2$-in. long, tested in the Soxhlet apparatus. The loss in weight for 50 hours of test for various enamels showed wide divergences between these enamels, which were of all types. The results showed losses from 0.0083 to 0.2241 gm. on the test sample.

The disadvantage of this test was that uniform test conditions were difficult to maintain. No two Soxhlet extraction units are exactly alike, and room-temperature variables cause wide variation of test conditions. To lessen this experimental error, the samples were run simultaneously in the same container. To accomplish this, a modified Soxhlet test was devised.

(3) Modified Soxhlet Test

The apparatus for this test consisted of a stainless-steel container, 10 in. in diameter and 5 in. deep, into which steam condensate could be introduced at a uniform rate and siphoned off with the dissolved salts after each filling of the container. The container was placed on a hot plate. The quantity of heat was largely controlled by the rate of flow of the condensate, the water temperature ranging from 158° to 194°F. Enameled tubes similar to those used in the standard Soxhlet test were again checked for weight loss. Five hundred hours of test gave losses ranging from 0.0240 to 1.5343 gm. for different enamels on the same-sized cylinders. Galvanized, copper, and Monel metal tubes showed weight variations of 0.1919, 0.0590, and 0.0394 gm., respectively. Sludge from the steam lines deposited on the enameled surfaces necessitated scrubbing the samples before weight losses could be determined. This undesirable feature was eliminated by employing a Barnstead still as the source of the condensate. This test, in general, was inadequate because of the length of time required to develop any degree of attack on the specimens. The alternate cooling and heating cycles considerably slowed the leaching process.

(4) Pressure-Temperature Tests

For this test, a modified steam vulcanizer was employed which gave pressures of 80 lb. per sq. in. at water temperatures ranging from 202° to 218°F. Distilled water was

* Received April 23, 1942; revised copy received November 28, 1942.

introduced into the modified steam vulcanizer, and pressure was applied by compressed air adjusted to insure continuous aeration. The results of this test were compared with those obtained with the modified Soxhlet extraction in a three-week test run on the same enamel. The pressure-temperature test showed much lower weight losses, but the attack on the enamel surface as judged visually was greater than indicated by the actual weight losses.

Although the effects of pressure should be considered, this test was unsatisfactory because circulation was impossible, a certain amount of salt build-up in the solution was unavoidable, and the metal container might conceivably contribute to misleading results by some form of base exchange.

(5) Frit Extraction Tests

Ten grams of frit, screened through a 28-mesh and retained on a 48-mesh U. S. standard sieve, were extracted with 0.02*N* sulfuric acid for 4 hours at 180° to 190°F. The percentage of sodium oxide and boric oxide extracted was obtained by titration. Distilled water and 0.02*N* sodium hydroxide were also tried as leaching media. The resistance of the frit to solution was judged by the total quantity of sodium oxide and boric oxide extracted. A definite relationship beween water extraction of the frit and weight losses of corresponding enameled surfaces in the modified Soxhlet apparatus was indicated, but extraction with either acid or alkali was totally unrelated.

The water-extraction test is evidently the most desirable, but here, too, a certain amount of salt build-up is unavoidable. Acid extraction probably comes closest to avoiding this failing, but in this case conditions of test are outside the range of service operations.

(6) Simulated Service Tests

A series of enameled tanks constructed to allow access to the interior for inspection was subjected to hot water to which salts had been added to produce conditions representing the most extreme types of water likely to be met in actual service. High temperatures ranging from 194° to 208°F., pressure, and aeration were also included. Length of satisfactory service under these varied conditions showed the enamel to be susceptible to changes in the character of the water. An enameled tank was also set up as a steam radiator by introducing live steam at 10 pounds pressure into the tank and using a return valve to remove condensate. The enamel showed extreme weakness in resisting this form of attack. It was impossible to change the water in these tanks more than twice a week, and the effects of the salts added diminished gradually. This and the fact that circulation induced by convection only was present were the weak points of the test. The value of the steam test was questioned because of its severity.

(7) New Autoclave Tests

In collaboration with the National Bureau of Standards, a series of autoclave tests was made. The degree of water attack on enameled surfaces was measured by the percentage of residual gloss remaining after the test. The apparatus available was not suitable for the high pressure recommended by the National Bureau of Standards. Pressure and temperature approximated 70 pounds and 312°F., respectively, whereas the length of test varied from 70 to 80 hours.

The results showed wide degrees of resistance for enamels of different compositions. This was to be expected, but the results were misleading, as, of all the enamels tested, the enamel with the highest gloss retention was an ordinary ground-coat enamel (two coats), whose previous record and composition would exclude it from water-tank service. On the other hand, an enamel resistant to water under actual service conditions lost gloss so rapidly as to be unmeasurable after 35 hours. The autoclave generally has proved to be unreliable as a means of determining durability in the glass industry. Little evidence to contradict this has been found in the present instance. The conditions of use are entirely outside the range of actual service conditions. Lack of aeration or circulation, salt build-up, and container contamination are all distinct disadvantages.

(8) Boiler Test

The latest test comprises a miniature boiler whose walls are either Pyrex-brand glass or enamel under test, constant renewal of water, and the application of maximum heat, i.e., actual boiling.

This test has not as yet been used extensively in our laboratory, but results generally have been satisfactory. Our tentative approval is directly due to the fact that, of all tests conducted, this test most ideally simulates actual service conditions. Its action, with the exception of degree of aeration, is similar to that of the modified Soxhlet apparatus, but it is more severe and thus gives more rapid results. A salt build-up is impossible, contamination is kept at a minimum, and the test is simple to operate. It fails, however, to duplicate actual service conditions because of the absence of pressure. This point may be questioned by some investigators. Another questionable point is the measurement of degree of attack. Loss of surface gloss may be influenced by many variables, such as the type and quantity of salts present in the mill liquor. This test fails to give a true indication of the over-all service life of the enamel. This method of selection should be correlated with long-time tests before total acceptance. The exact end point in the correlation to actual service conditions must be determined accurately.

This test, however, offers the most promise of any tests tried in our laboratory.

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Discussion by G. E. Terry*

Before entering into the discussion of the tests being made in our laboratory on water-heater tank enamels, I should like to present a brief summary of our position in regard to the testing of these enamels.

We manufacture complete water heaters for which all tanks, galvanized, Monel metal, or porcelain enameled, are purchased from outside sources.

* Received April 27, 1942.

The water-heater department became interested in obtaining a more durable coating than galvanized iron for their tanks eight or ten years ago. The problem was given to the Ceramic Section of the Engineering Department for an investigation of the possibility of a porcelain enamel finish for the tanks. Many manufacturers were contacted but none seemed interested in this work at that time. In 1935, we found an organization doing considerable research work on the problem and cooperative tests were begun. Our present tests are the outgrowth of the work begun in 1935 by Harry Holscher. The tests have been long-term service tests rather than a short-term development test.

(1) Tests on Laboratory-Prepared Samples

The first method comprises immersing small laboratory samples in hot distilled water under air pressure. The equipment consists of a 15-gallon thermally insulated Monel metal tank with a Monel metal-clad removable head. A ring of Monel metal is fastened to the top of the tank, from which the samples to be tested are suspended by stainless steel wires. The distilled water is heated by an electric immersion unit and thermostatically controlled at 190°F. Air is introduced into the top of the tank at a pressure of 70 lb. per sq. in., and a small vent in the top of the tank permits continuous renewal of the air. The water is changed every two weeks.

Two types of test pieces are used, viz., (1) a 20-gauge 1- by 3-in. open-end cylinder with a $^1/_4$-in. hole at one end for hanging and (2) a 6-in. hollow closed-end cylinder of cold-rolled steel with a wall $^1/_4$ in. thick, one end of which is tapped and threaded for a Monel metal cap. The cylinders are finished to a definite weight in a standard ground coat and two coats of the special water-heater enamel under test.

All samples are inspected carefully under the microscope before immersion to detect any defects and to observe the bubble structure. The test has been conducted for the past year with the samples being removed at 30-day intervals for inspection. A weight-loss study on the samples was attempted, but after 30 days of immersion in the water, due to rusting and corrosion along the edges of a few samples, the results did not correlate the observed corrosion of the surfaces.

(2) Tests on Full-Sized Water-Heater Tanks

In an attempt to correlate results of this method, we have tested a number of full-sized tanks coated with various enamels. The tanks were filled with Chicago water (which is comparatively soft) under air pressure of 70 lb. per sq. in. with the water temperature varying between 170° and 190°F. The water in the tanks was changed every two weeks.

(3) Field Tests

After the preliminary testing in the laboratory, we obtained 41 enameled tanks from one manufacturer whose enamel had shown promise. These tanks were distributed over the country to obtain the maximum number of water conditions to be encountered in service. Tanks were placed as far north as Maine, east along the Atlantic seaboard, south to Virginia, and as far west as the State of Washington. In most cases, the tanks were placed in locations where our previous experience had shown the water to be particularly corrosive. The waters varied from natural soft, zeolite softened, to extremely hard water. Hydrogen ion values were 5.7 to 8.3. Water temperatures in the tanks varied from 145° to 190°F. The tanks were inspected after being in service from seven months to a year, and those tanks suspected of exhibiting corrosion were returned to the laboratory to be cut open for close examination. The enameled surfaces of the tanks were in excellent condition. Tanks showing evidence of corrosion had surfaces lightly etched with no pinholing or selective attack.

Field tests corroborated our distilled-water laboratory test. Tanks with the greatest amount of corrosion had surfaces similar in appearance to the samples immersed in distilled water for the same period of time. It was encouraging to find that the porcelain enameled tanks withstood all water conditions satisfactorily.

(4) Additional Data

Heavy-gauge samples should be used to approximate the firing conditions of actual tanks, the enamels should be applied at a definite weight, and the mill addition of the enamel should be adjusted to give a minimum bubble structure. Each test specimen should be carefully inspected under magnification to give a record of the surface condition before immersion in the water.

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THE EARLY CERAMIC ARTS AS A REFLECTION OF CHINESE ESTHETIC IDEALS*

By Walter Read Hovey

Abstract

The following topics are discussed: (1) forms; (2) pictorial designs, (*a*) painted, (*b*) incised, and (*c*) stamped; and (3) ceramic sculpture, (*a*) interpretations of subjects and (*b*) technique.

The significance of art as a reflection of general attitudes of life needs no comment, but to discuss in some detail certain splendid achievements of the ceramic craft and relate them to the esthetic instincts of the race which produced them may have far-reaching implications. As Germany has been pre-eminent in music, England in literature, Italy in painting, China has reigned supreme in the field of ceramics. The reasons for these fields of emphasis are frequently beyond our grasp, yet in the case of China there is such a kinship between ideals and qualities inherent within the medium of clay as to make the beauty of their products inevitable. It is these relationships during the formative period of the Chinese esthetic ideal and up to the introduction of a philosophy of life foreign to the Chinese temperament under Kublai Khan that are now briefly discussed.

Much of this material is of peculiar interest because of the recentness of its discovery. Within the last twenty years, archeological expeditions have followed the old trade routes across Asia, railroads have opened up new districts disturbing many a buried treasure in their progress, and recent scholarship has given an entirely new emphasis to the early dynasties.

The student of Chinese art is ever conscious of two traits, a respect for tradition and a sense for the quickening spirit of nature. Lawrence Binyon speaks of their art as possessing "a continuity with the primitive and slowly widening and all-embracing sympathy with living things. It has its roots deep in the earth." This, in short, is Taoism. In the formation of clay by human hands, mind and matter meet and matter becomes spiritualized. But before the transformation of clay into its final beauty, other media and other techniques, those of jade and bronze, were to obtain the chief esthetic interest. This was a natural evolution. Jade had only to be carved and polished, bronze to be melted and cast, but clay had to be fired and glazed. The shapes of one medium were transferred to the other, and in this continuity due to ritualistic symbolism we see the respect for tradition, the spirit of Confucius. Berthold Laufer speaks of the ability of the Chinese to reduce religious ideas to measurable quantities expressed by numbers. Of course he is speaking of their speculations in astronomy and mathematics, but we see its application in the precision of the shapes of their ritualistic vessels. The Chinese always wished to maintain a kinship between the form and the content. Their sense of the quickening spirit of nature gave their forms the essence of life, the spirit of Lao-tzu. Lao-tzu even created a synthesis between existence and nonexistence. His followers, the Zen Buddhists, drew from ceramics in order to press this point, saying: "Clay is molded into a vessel; the utility of the vessel depends on its hollowness." Thus, although the existence of things may be good, it is the nonexistence in them which makes them serviceable. Utility was never separated from beauty in the early Chinese ideal. They were unconscious of those western distinctions between major and minor arts, fine arts and decoration, industrial or commercial arts. Of course, the ceramic medium captivated them. It dealt with the elements earth, air, fire, and water, and, if they found the process of creating an exquisite substance through patient trial and experiment rather than through scientific reasoning, it had the added beauty of respect for the mystic forces of nature.

Fig. 1.—Neolithic jar from Kansu, ca. 3000 B.C. (from collection of Walter R. Hovey).

This is the significance of the dragon motif, the prototype of which is found in the neolithic pottery spirals such as in a jar from Kansu (Fig. 1). This painted ware, so beautifully fashioned of walls of even thinness, dates from about 3000 B.C. Though a grave object, it is decorated with a symbol of constant change or never-ending life. In this way, the defeat of death was denied. The pattern is prevalent among primitive peoples everywhere. It became conventionalized into the Greek fret but in China enjoyed a special and enduring popularity. Its early stylization is prevalent in ritual-

* Presented at the Forty-Fifth Annual Meeting, The American Ceramic Society, Inc., Pittsburgh, Pa., April 21, 1943 (Art Division). Received July 21, 1943.

istic bronzes. Probably such pottery fragments as those from Anyang, the capital of the Shang dynasty from the earliest historic period, 16th to 11th century B.C., were inspired from contemporary bronze forms. Later funerary urns, such as a Tang amphora or a beautiful Sung celadon jar, made use of the dragon (Fig. 2). The thought is essentially the same, for among other things the dragon was the symbol of change. But it is easy to digress into Chinese symbolism.

That this jar in its exquisite glaze of Lung Chuan celadon suggests jade is most significant. Chinese legend speaks of jade disks used for funerary rites as "crystallized fragments of moonlight." There can be no doubt but that the desire to create something suggestive of and akin to nature was the secret of the beauty of Sung ware. Chinese ceramic literature is filled with poetic references from nature. Phrases such as "sky after rain" and "partridge or hare fur bowls" constantly occur. Blemishes were called earthworm marks or the Black Ting ware was spoken of as "rare as the black swan." The celadons in the shape known as Tsung were certainly inspired from the jade form of archaic times. The Tsung was a hollow tube, cylindrical within but square without. It was used for grain, and the square form symbolized the four cardinal points of the earth. It is ornamented with the Pa Kwa design or eight basic concepts. This, in fact, is the reason for the frequent occurrence in Chinese ceramics of the octagonal shape, each panel of which is suited to contain a figure of one of the Eight Immortals. That is, the Immortals were but a humanizing, through Buddhism, of the primitive geometric symbols for the elements.

FIG. 2.—Funerary urn with dragon motif, Lung Chuan, Sung dynasty (from collection of C. T. Loo, New York).

FIG. 3.—Pottery li, Chou dynasty (from collection of Walter R. Hovey).

The technical secret of Chinese ware lies in the early discovery of a porcelaneous medium which could take an intense heat. Stoneware vessels occur in the early dynasties, and the eventual development of the hard porcelaneous glazes is the marvel of their craft. Nothing has ever surpassed the richness of Sung celadons which by their very defects seem closer to nature than the more technically accomplished Ming copies. Indeed, connoisseurs of the 19th and early 20th centuries have tended to overlook the essential quality of true ceramic beauty, so fully realized in the Sung period, because of the amazing skill displayed in the later ware. This unfortunately has been, perhaps too often, the envy of our potters rather than the spirit of the earlier work.

The full force of the Chinese canon of art is displayed in the shapes of the early bronzes for ritualistic use. Although weirdly mystical, the power of their forms lies in their derivation from utilitarian vessels. The so-called Li tripod first done in pottery (Fig. 3) for a better distribution of heat became a bronze ritual form (Fig. 4). The vigor of these forms was suited to bronze, and, al-

though they were constantly repeated in pottery at later periods, the finest efforts made modifications to suit the different medium and use. The rare Chün bulb bowl of the Sung period (Fig. 5) appropriately maintains the bronze prototype (Fig. 6). The rich unctious glaze is best displayed by the large, smooth curves, and the utilitarian purpose requires the heavy effect. The colors of this ware are of unsurpassed depth, ranging from the delicate blue of a cold winter sky to the rose purple of a fiery sunset. The coloring is due to the oxidation of copper, and, like the early stained glass of Europe, has a richness resulting from a certain lack of precision. To borrow from Hobson, perhaps our foremost authority, the glaze retains the vitality which one knows to have existed in that perpetual war waged in the kiln among red, gray, and blue elements. It suggests an exquisite thing to be used. In the lovely pear-shaped Sung vases, the evolution of which may be traced from the old bronze forms, we again have a practical origin. As containers for hot water they had long narrow necks and small mouths. The Sung ware, in general,

FIG. 4.—Bronze li, Chou dynasty (from collection of Sumitomo Kichizaemon, Osaka).

FIG. 5.—Bulb bowl, Chün ware, Sung dynasty (from Eumorfopoulos Collection, London).

FIG. 6.—Tsun (wine vessel) with T'ao t'ie decoration, Chou dynasty (from collection of C. T. Loo, Paris).

was close to the spirit of the early Chou and Shang bronzes wherein one finds a fusion of decoration and form, whereas the preceding Tang period followed the Han bronze prototypes in which decoration was instead subordinated to form. In looking at a collection of Sung ware, one is reminded of a Chinese quotation from the 5th century B.C.: "Ornamentation detracts from the merit of pottery."

With the Han dynasty, 206 B.C.–A.D. 220, a revolution in taste occurred. The opening up of the trade routes across Asia brought in foreign influences—Syrian, Persian, and Indian. Individual variability asserted itself, and this eventually had a splendid outlet in figurines, painted ware, and glazes. Yet the old Taoist spirit persisted. The bronze hill jars suggest the seagirt isles of the Taoist immortals. The form becomes more realistic, less animated. Yet it is decorated with figures of the chase. Large numbers of pottery hill jars (Fig. 7) are extant, all made in a mold and imitating the more costly bronze. The Han wine vessels, unglazed, but in a polished black ware, provide another excellent example of the relation-

ship to bronze. They are frequently decorated with lively incised drawings of symbolic animals. Although a distant heritage of lunar worship, their vitality still persists.

Shortly after the Han period, unglazed painted ware was popular. The brush became an expressive medium, and pottery was found to be an excellent surface upon which to work. Architectural tile was thus decorated with some of the loveliest drawings in art. The Persian sense for two-dimensional pattern and color was in vogue

FIG. 7.—Hill jar, Han dynasty (from collection of Walter R. Hovey).

yet never reigned supreme. As the Chinese undoubtedly derived the knowledge for the development of the glaze from the west but followed their own instincts in its evolution, so in the designs they maintained their integrity. Persian influences can also be noted in the shapes. Further evidence of this intercourse occurs in the recent excavations from Samarra which have revealed many Chinese examples. The culmination of this influence came in the Tang period, the ware of which is characterized by bold shapes and fine surface patterns. Each element seems to have been worked out as an exquisite thing in itself, yet they are blended into an harmonious whole. It was at this time that cobalt was brought from the west for the fine blue enamelware.

Then the decoration became more subtle. It is perhaps best shown in the famous bowls of Ting ware, in which the drawing is incised beneath the glaze in such a way as to be unthinkable when separated from its setting. Even in figure painting this principle of a fusion with the object itself holds true, and one marvels at the great Chinese tradition of calligraphy which developed such quickness and sureness of control (Fig. 8).

Yet it was at this time and particularly at the kilns of Tzu-Chou that one notes the beginning of that technical dexterity which was later to run riot and overshadow the true beauty of the ceramic medium. It began with overglaze painting which involved a second firing at a lower temperature. This was the first step in the long and brilliant evolution of enamel glazes. It is not strange that the true essence of the Sung spirit seems to reside in the floral forms. The forced withdrawal of the court to the

FIG. 8.—Gallipot vase, Tzu-Chou, Sung dynasty (from collection of Walter R. Hovey).

south in the 12th century may have resulted as a solution to worldly defeat in that preoccupation with the intangible and subtle moods of nature to which we constantly refer. Connoisseurship was developed to a high point, but dexterity was subordinated to nature as the key: not the

particular object but the essential spirit behind it. The ware reveals now, in a sophisticated refinement, that same hypnotic spell of nature which primitive brutality manifested by grotesque monster forms. This synthesis was only possible as a result of the individual and humanizing forces of the intervening Tang period.

The emphasis on man is felt in Tang sculpture. Space is too limited to discuss the caves of Lung Men with their Greco-Buddhist influences, but the sepulchral figurines so numerous in Tang times were an essentially Chinese response to those outside influences. They speak of the realism of the outside world, the wealth of the trade routes, and the importance of the military control through superior horses and armor and organization. Such figures are made in molds glazed or unglazed and reveal all the steps in that usual cycle of art from ineptitude to complete realization and then away from the ideal to too great a preoccupation with technique and unessentials.

It is but natural that the vigor of Tang art should find its fullest manifestation in sculpture. A seated Lohan[1] from a Buddhist temple now preserved in the British Museum has been called by Hobson the finest example of modeling in ceramics. Its size, 50 inches in height, must have great y taxed the ingenuity of the artist technician. But its greatness must lie rather in the desire to express through the human figure the mystic power of Buddhism, which in China was never quite separated from the older Taoist ideals.

It is fitting to conclude with a figure of philosophical power, real and personal, rather than with an exquisite Sung porcelain because in the art of the Tang period we have a closer relationship to our own times.

Our subject has been the Chinese esthetic ideal. This is not necessarily *our* ideal. We have not discovered an absolute beauty but rather an indication of how changing social conditions result in different tastes and standards. Today our interests must be turned to a more forceful medium than that which we have been discussing but, as China found her esthetic strength in bronze and then refined and perfected it in ceramics, so must we evolve our own ideals and fired with the unlimited possibilities of the ceramic medium create out of it a great American art.

[1] Illustrated in Chinese Pottery and Porcelain by R. L. Hobson, Vol. 1 (frontispiece). Cassell & Co., Ltd., London, 1915.

Department of Fine Arts
University of Pittsburgh
Pittsburgh, Pennsylvania

AN IMPROVED LABORATORY POLARISCOPE OF SIMPLE DESIGN*

By John Gallup

I. Introduction

During the course of recent laboratory examinations of a variety of sizes and shapes of strained glass radio-tube parts in polarized light, the need for a versatile polariscope of inexpensive design became apparent. The simple polariscope described here was therefore designed and built in the laboratory from inexpensive standard materials and parts.

II. Desirable Features

The desirable features which this polariscope embodies are as follows:

(1) A uniform light intensity over the field.

(2) A uniformly polarized field.

(3) A uniform color over the field.

(4) Binocular vision without eyepieces or lenses to cause eye fatigue.

(5) A wide field of view.

(6) Freedom from extraneous light, i.e., freedom from reflected room light.

(7) A vertical system which allows the strained object under view to be laid directly over the bottom polarizer beside the strain standards, leaving both hands free for manipulating the standards.

(8) A convenient arrangement for viewing small curved objects immersed in a beaker of liquid of appropriate index to remove reflection effects.

(9) A direct-viewing arrangement without the confusing reversal of image which occurs with the use of a mirror analyzer.

(10) A readily removable tint plate.

(11) A simple design which can be quickly constructed from readily available standard materials at a small total cost.

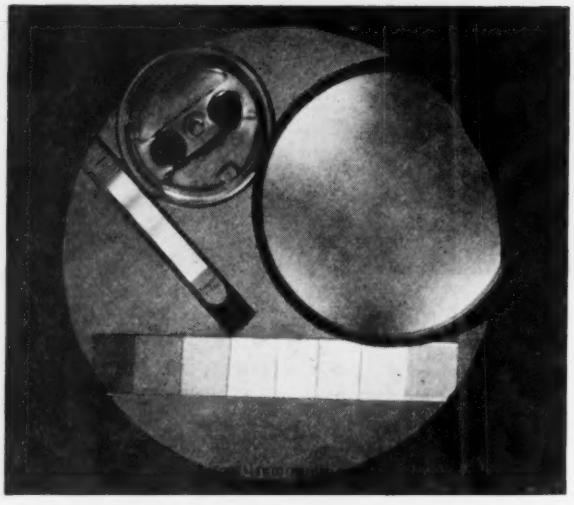

Fig. 1.—Black-and-white photograph of a strained glass stem in the polariscope, together with the Glass Container Association Annealing Standards, a quartz wedge, and a large mica step-wedge made by the writer. Color densities are not correctly reproduced owing to the selective color sensitivity of the film. The uniformity of field and the general appearance of birefringent materials in the polariscope field are represented correctly.

A uniform light intensity is obtained by diffusing the light from a 3200°K., 500-watt bulb successively through a standard opal glass illuminating shade and a sheet of lightly frosted glass.

A uniformly polarized field results from the use of a sheet

* Received July 30, 1943.

of black Carrara glass set at the polarizing angle for red light plus a sheet of Polaroid "J" film placed above the mirror with the polarization direction of the Polaroid parallel with that of the mirror. This results in more

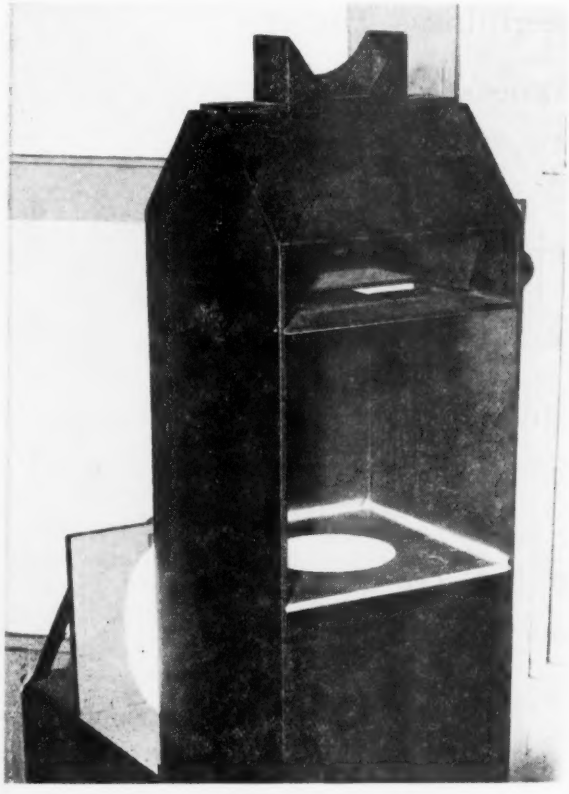

FIG. 2.—Improved laboratory polariscope.

complete polarization than is possible with either polarizer alone with the light source used. The "J" film is supported on a sheet of clear, double-thick window glass and may be protected from solvents by covering with a sheet of strain-free glass.

A uniform color over the field is obtained by using a sensitive tint plate made by splitting clear mica and piling up the layers to secure the desired red color. The tint plate now in use is $4^1/_2$ in. square and was made from mica discarded for other purposes because of scratches and discoloration. These mica defects do not affect the interference color noticeably. The important factor is uniform thickness.

The analyzer is a $4^1/_2$-in. square of Polaroid "H" glass. This large and comparatively expensive analyzer was chosen because of its excellent polarization and because of the desire to eliminate the eye fatigue which arises from using one eye or even both eyes to look through eyepieces.

A wide field of view is readily available as the large opal shade (1 foot in diameter), the black Carrara mirror, and the "J"-film polarizer are inexpensive and as the field is not limited by eyepieces.

Freedom from all extraneous light results from the enclosure of the operating space on three sides. The operator's body closes the fourth.

(1944)

The vertical system supports the specimens in the examination position, leaving the hands free to manipulate the strain standards. It also facilitates the examination of small curved objects immersed in a liquid of appropriate

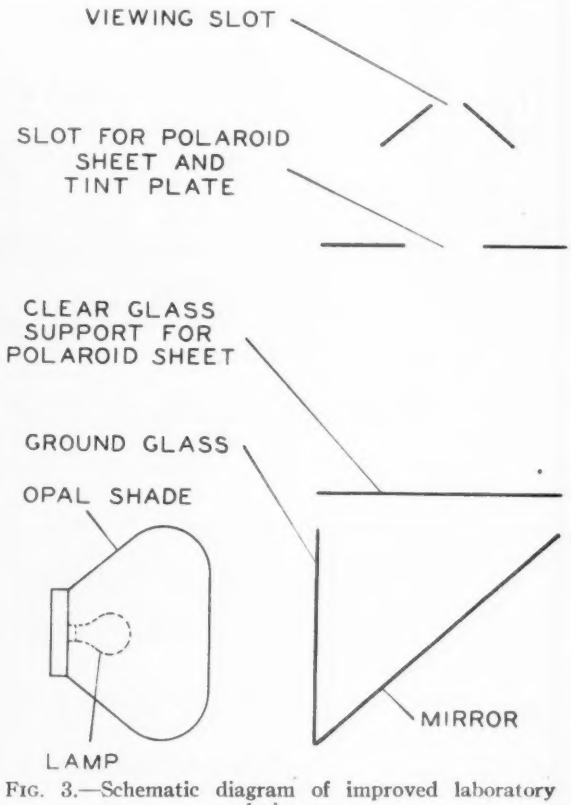

FIG. 3.—Schematic diagram of improved laboratory polariscope.

index to remove reflection effects as the container need have only a flat strain-free bottom. Practically any Pyrex-brand glass beaker will suffice.

The direct-viewing arrangement does not invert or reverse right and left as is the case with polariscopes using a mirror analyzer.

The tint plate supported in grooves just below the analyzer can be slid to one side to permit observation of black-and-white strain figures.

The material used in the construction of the polariscope* is $^1/_4$-in. plywood obtainable at any lumber supply establishment. The black Carrara glass is sold by plate-glass companies. The Polaroid is obtained from the Polaroid Corporation of Cambridge, Massachusetts. The 3200° Kelvin bulb may be obtained at camera supply stores.

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* Approximate list prices of essential components at the time of construction were as follows: Black Carrara glass $1.50 per sq. ft.; "J" Polaroid film $12 per sq. ft.; "H" Polaroid glass, $16 per $4^1/_2$-in. square; lightly sanded window glass 35¢; clear, double-thick window glass 25¢; 3200° K., 500-watt bulb 75¢.

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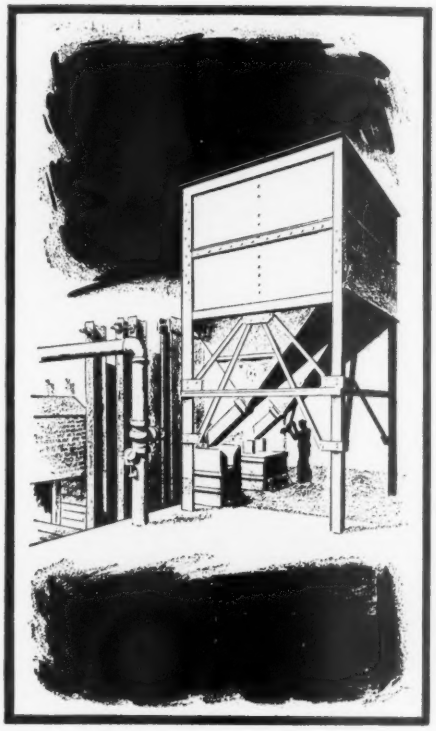

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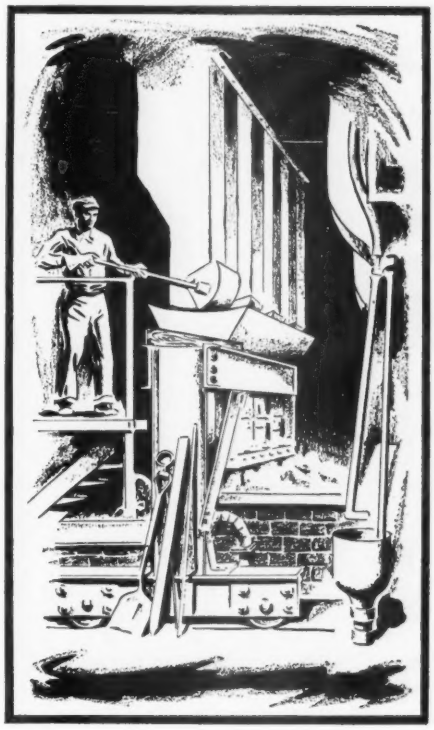

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Leeds & Northrup Co.

Cone Plaques
Industrial Ceramic Products, Inc.

Cones
The Edward Orton Jr., Ceramic Foundation

Controllers—Automatic Tank Pressure
Leeds & Northrup Co.

Conveying Equipment
Frazier-Simplex, Inc.
Lancaster Iron Works, Inc.
National Engineering Co.

Copper Oxide
Drakenfeld, B. F., & Co.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.

Corhart
Corhart Refractories Co.

Cornwall Stone (Imported)
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
Hammill & Gillespie, Inc.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
Maxson, Elwyn L.

Crucibles (Filter, Melting, Ignition)
Carborundum Co.
Norton Co.
Potters Supply Co.

Crushers (Clay)
Lancaster Iron Works, Inc.

Cryolite (see Kryolith)
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
Pennsylvania Salt Mfg. Co.
The Vitro Mfg. Co.

Crystolon (Refractory Products)
Norton Co.

Cullet, Washing Plants, Incinerators, Crushers
Frazier-Simplex, Inc.

Cutters (Bar)
Industrial Ceramic Products, Inc.

Cutters: Diamond impregnated wheel type
Felker Mfg. Co.

Decorating Supplies
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
The Vitro Mfg. Co.

Disintegrators
Lancaster Iron Works, Inc.
National Engineering Co.

Dryer (Pipe Rack)
Lancaster Iron Works, Inc.

Dryers (Waste Heat, Continuous and Batch Type)
Harrop Ceramic Service Co.

Drying Machinery
Frazier-Simplex, Inc.
Lancaster Iron Works, Inc.
Proctor & Schwartz, Inc.

Electrocast Refractories
Corhart Refractories Co.

Enamelers' Borax
Porcelain Enamel and Mfg. Co.

Enameling Equipment (Complete)
Frazier-Simplex, Inc.
The Hommel, O., Co., Inc.
The Vitro Mfg. Co.

Enameling Furnaces
Carborundum Co.
The Hommel, O., Co., Inc.
Lancaster Iron Works, Inc.
Norton Co.

Enameling Iron (Sheet)
American Rolling Mill Co.

Enameling Muffles
Carborundum Co. (*Carbofrax*)
Frazier-Simplex, Inc.
Norton Co. (*Alundum*)

Enameling (Practical Service)
The Hommel, O., Co., Inc.
Metal & Thermit Corp.
Porcelain Enamel and Mfg. Co.
Titanium Alloy & Mfg. Co.
The Vitro Mfg. Co.

Enamels
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
Porcelain Enamel and Mfg. Co.
The Vitro Mfg. Co.

Enamel Oxide
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.

Enamels (Porcelain)
The Hommel, O., Co., Inc.
Porcelain Enamel and Mfg. Co.
Titanium Alloy & Mfg. Co.
The Vitro Mfg. Co.

Engineering Service
Harrop Ceramic Service Co.

Equipment (Porcelain Enameling)
The Hommel, O., Co., Inc.

Feldspar
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
Maxson, Elwyn L.
Porcelain Enamel and Mfg. Co.
The Vitro Mfg. Co.

Filter Fabrics
Metakloth Company

Fire Brick
Carborundum Co.
Corhart Refractories Co.
Electro Refractories & Alloys Corp.
Norton Co.

Fire Brick—Process Equipment
Lancaster Iron Works, Inc.

Fire Clay
Great Lakes Foundry Sand Co.
Spinks, H. C., Clay Co.

Flint
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
Great Lakes Foundry Sand Co.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
Maxson, Elwyn L.
Porcelain Enamel and Mfg. Co.

Flint Pebbles
The Hommel, O., Co., Inc.
The Vitro Mfg. Co.

Floors (Non-Slip)
Norton Co.

Fluorspar
Harshaw Chemical Co.
The Hommel, O., Co., Inc.

French Flint
Maxson, Elwyn L.

Frit
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
Porcelain Enamel and Mfg. Co.
Titanium Alloy & Mfg. Co.
The Vitro Mfg. Co.

Frosting Mixtures
Drakenfeld, B. F., & Co.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.

Fuel Oil Systems and Control Stokers
Frazier-Simplex, Inc.
Harrop Ceramic Service Co.

Furnaces
Carborundum Co. (*Carboradient*)
Frazier-Simplex, Inc.
Harrop Ceramic Service Co.
The Hommel, O., Co., Inc.
Swindell-Dressler Corp.

Furnaces, Enameling
Swindell-Dressler Corp.

Gauges, Draft (Recording, Indicating)
Leeds & Northrup Co.

Gauges, Pressure
Leeds & Northrup Co.

Glass Bending Ovens, Glass Decorating Machines
Frazier-Simplex, Inc.

Glass Equipment
Lancaster Iron Works, Inc.

Glass Melting Tanks and Furnaces
Frazier-Simplex, Inc.

Glass Sand
Great Lakes Foundry Sand Co.

Glass Thickness Gauge
Bausch & Lomb Optical Co.

Glaze and Body Spar
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
Maxson, Elwyn L.
Porcelain Enamel and Mfg. Co.
The Vitro Mfg. Co.

Glazes and Enamels
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
Porcelain Enamel and Mfg. Co.
Titanium Alloy & Mfg. Co.
The Vitro Mfg. Co.

Glaze Spar
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
Maxson, Elwyn L.

Goggles
The Hommel, O., Co., Inc.

Gold
Drakenfeld, B. F., & Co.

Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
The Vitro Mfg. Co.

Gold Decorations
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
The Hommel, O., Co., Inc.

Granulators
Lancaster Iron Works, Inc.

Grinding Wheels
Carborundum Co. (*Carborundum and Aloxite*)
Electro Refractories & Alloys Corp.
Norton Co. (*Alundum-Crystolon*)

Hearths
Carborundum Co. (*Carbofrax* heat treating)
Corhart Refractories Co.
Norton Co. (*Crystolon*)

Hearths (High Aluminous Clay, Electrically Sintered Aluminum Oxide, Silicon Carbide)
Carborundum Co.
Norton Co.

Hydrofluoric Acid
Harshaw Chemical Co.
The Hommel, O., Co., Inc

Iron Chromite
Harshaw Chemical Co.

Iron (Enameling)
American Rolling Mill Co.

Iron Oxide
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
Foote Mineral Co.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
Porcelain Enamel and Mfg. Co.
The Vitro Mfg. Co.

Kaolin
Hammill & Gillespie, Inc.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
Maxson, Elwyn L.
The Vitro Mfg. Co.

Kilns, China (Decorating)
Drakenfeld, B. F., & Co.
Frazier-Simplex, Inc.
Harrop Ceramic Service Co.
The Hommel, O., Co., Inc.
Swindell-Dressler Corp.

Kilns (Electric, Circular, Tunnel)
Ferro Enamel Corp.
Harrop Ceramic Service Co.
Swindell-Dressler Corp.

Kiln Furniture (Silicon Carbide, Semi-Silicon Carbide) (Refractory)
Carborundum Co.
Electro Refractories & Alloys Corp.
Ferro Enamel Corp.

Kryolith (see Cryolite)
Pennsylvania Salt Mfg. Co.

Laboratory Ware
Norton Co.

Lehr Tile (High Aluminous Clay, Electrically Sintered Aluminum Oxide, Silicon Carbide)
Carborundum Co.
Electro Refractories & Alloys Corp.

Lehrs
Frazier-Simplex, Inc.
Swindell-Dressler Corp.

Lehrs (Electric or Fuel Heated)
Frazier-Simplex, Inc.
Swindell-Dressler Corp.

Lehr Loaders
Frazier-Simplex, Inc.

Linings (Furnace Refractory, Block Refractory Plate, Brick, and Tile)
Carborundum Co.
Corhart Refractories Co.
Electro Refractories & Alloys Corp.
Norton Co.
The Vitro Mfg. Co.

Lithium Carbonate
Drakenfeld, B. F., & Co.
Foote Mineral Co.

Lithium Minerals
Foote Mineral Co.

Loaders (Bucket)
National Engineering Co.

Magnesia (Fused)
Electro Refractories & Alloys Corp.
Norton Co.

Magnesia (Sintered, Calcined)
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
Porcelain Enamel and Mfg. Co.

Magnesite
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
Foote Mineral Co.
Hammill & Gillespie, Inc.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
The Vitro Mfg. Co.

Magnesite Calcined
Foote Mineral Co.
The Hommel, O., Co., Inc.

Magnesium Carbonate
Drakenfeld, B. F., & Co.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.

Manganese
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
Hammill & Gillespie, Inc.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
The Vitro Mfg. Co.

Manganese Dioxide
Drakenfeld, B. F., & Co.
Foote Mineral Co.

Manganese (Oxide)
Corhart Refractories Co.
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.

Masks (Breathing)
Drakenfeld, B. F., & Co.

Metals (Porcelain Enameling)
American Rolling Mill Co.

Micronized Products
Porcelain Enamel and Mfg. Co.

Microscopes (Polarizing)
Bausch & Lomb Optical Co.
Spencer Lens Co.

Microscopes (Stereoscopic)
Bausch & Lomb Optical Co.
Spencer Lens Co.

Minerals
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
Foote Mineral Co.
Hammill & Gillespie, Inc.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
The Vitro Mfg. Co.

Mixers
Clearfield Machine Co.
National Engineering Co.

Mixers (Batch)
Clearfield Machine Co.
Lancaster Iron Works, Inc.
National Engineering Co.

Mixers (Concrete, Paving, Road Paving, Plaster, Asphalt, Truck, Mortar, Bituminous)
Lancaster Iron Works, Inc.

Mixers (Laboratory)
Lancaster Iron Works, Inc.
National Engineering Co.

Mold Sanders
Lancaster Iron Works, Inc.

Muffles (Furnace) (Laboratory)
Carborundum Co. (*Carbofrax*)
Electro Refractories & Alloys Corp.
Frazier-Simplex, Inc.
Norton Co.

Mullers (Batch)
Clearfield Machine Co.
Lancaster Iron Works, Inc.
National Engineering Co.

Muriatic Acid
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
Pennsylvania Salt Mfg. Co.

Needle Antimony
Foote Mineral Co.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.

Nepheline Syenite
Great Lakes Foundry Sand Co.

Nickel Salts
Drakenfeld, B. F., & Co.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.

Nitrates (Cobalt, Sodium)
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
The Vitro Mfg. Co.

Nitre
Harshaw Chemical Co.
The Hommel, O., Co., Inc.

Norbide (Norton Boron Carbide)
Norton Co.

Olivine
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.

Opacifiers
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
Metal & Thermit Corp.
Pennsylvania Salt Mfg. Co.
Porcelain Enamel and Mfg. Co.
Titanium Alloy & Mfg. Co.
The Vitro Mfg. Co.

Overglaze Colors
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
Ferro Enamel Corp.

Oxides
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
Ferro Enamel Corp.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
Metal & Thermit Corp.
Porcelain Enamel and Mfg. Co.
Titanium Alloy & Mfg. Co.
The Vitro Mfg. Co.

Palladium Decorations
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
The Hommel, O., Co., Inc.

Pans—Wet and Dry
Clearfield Machine Co.

Pins
The Hommel, O., Co., Inc.
Industrial Ceramic Products, Inc.
Potters Supply Co.

Placing Sand
Great Lakes Foundry Sand Co.

Platinum Decorations
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
The Hommel, O., Co., Inc.

Polariscopes
Bausch & Lomb Optical Co.
Frazier-Simplex, Inc.

Porcelain Enameling Service (Practical)
American Rolling Mill Co.
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
Ferro Enamel Corp.
The Hommel, O., Co., Inc.
Porcelain Enamel and Mfg. Co.
Titanium Alloy & Mfg. Co.
The Vitro Mfg. Co.

Porcelain Enamels
Ferro Enamel Corp.
The Hommel, O., Co., Inc.
Porcelain Enamel and Mfg. Co.
Titanium Alloy & Mfg. Co.
The Vitro Mfg. Co.

Potash (Carbonate)
Du Pont de Nemours, E. I., & Co. Inc., Electrochemicals Dept.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
Solvay Sales Corp.
The Vitro Mfg. Co.

Producer Glass Plants
Frazier-Simplex, Inc.

Pug Mills
Lancaster Iron Works, Inc.

Pyrites (Natural Iron Sulphide)
Foote Mineral Co.
The Hommel, O., Co., Inc.

Pyrometer Tubes
Carborundum Co.
Leeds & Northrup Co.
Montgomery Porcelain Products Co.

Pyrometer Tubes (Refractory and Hard Porcelain)
Electro Refractories & Alloys Corp.
McDanel Refractory Porcelain Co.
Montgomery Porcelain Products Co.
Norton Co.

Pyrometers (Optical, Radiation, Surface, Immersion, Needle)
Leeds & Northrup Co.

Pyrometric Cones
The Edward Orton, Jr., Ceramic Foundation

Raw Material Handling Equipment
Frazier-Simplex, Inc.
Lancaster Iron Works, Inc.

Recorders, CO_2
Leeds & Northrup Co.

Recorders, Draft
Leeds & Northrup Co.

Recorders, Tank Pressure
Leeds & Northrup Co.

Refractometers
Bausch & Lomb Optical Co.
Electro Refractories & Alloys Corp.
Spencer Lens Co.

Refractories
Carborundum Co.
Corhart Refractories Co.
Electro Refractories & Alloys Corp.
Norton Co.

Refractory Materials
Carborundum Co.
Corhart Refractories Co.
Electro Refractories & Alloys Corp.
Norton Co.
Titanium Alloy & Mfg. Co.

Respirators
Drakenfeld, B. F., & Co.
The Hommel, O., Co., Inc.

Rutile
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
Foote Mineral Co.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
Metal & Thermit Corp.
The Vitro Mfg. Co.

Saggers
Carborundum Co.
Electro Refractories & Alloys Corp.
Norton Co.
Potters Supply Co.

Salt Cake
American Potash & Chemical Corp.
Drakenfeld, B. F., & Co.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
Pennsylvania Salt Mfg. Co.

Sandblast Sand
Great Lakes Foundry Sand Co.

Sand Grinders and Sifters
Lancaster Iron Works, Inc.

Saponin
The Hommel, O., Co., Inc.

Saws: Diamond impregnated for cutting off
Felker Mfg. Co.

Screening and Magnetic Separators
National Engineering Co.

Selenite of Sodium
Drakenfeld, B. F., & Co.
The Hommel, O., Co., Inc.
The Vitro Mfg. Co.

Selenium
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
Foote Mineral Co.
Harshaw Chemical Co.
The Hommel O., Co., Inc.
The Vitro Mfg. Co.

Sheets (Enameling Iron)
American Rolling Mill Co.

Silica (Fused)
Electro Refractories & Alloys Corp.
Foote Mineral Co.
The Hommel, O., Co., Inc.

Silicate of Soda
Harshaw Chemical Co.
The Hommel, O., Co., Inc.

Silicon Carbide
Carborundum Co.
Electro Refractories & Alloys Corp.
Norton Co.

Silicon Carbide Firesand
Carborundum Co.

Sillimanite Refractories
Electro Refractories & Alloys Corp.

Slabs (Furnace)
Carborundum Co.
Electro Refractories & Alloys Corp.
Norton Co.

Soda Ash
American Potash & Chemical Corp.
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
Pennsylvania Salt Mfg. Co.
Solvay Sales Corp.
The Vitro Mfg. Co.

Sodium Antimonate
Drakenfeld, B. F., & Co
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
Metal & Thermit Corp.
The Vitro Mfg. Co.

Sodium Fluoride
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
The Vitro Mfg. Co.

Sodium Metasilicate
Harshaw Chemical Co.

Sodium Nitrite
Harshaw Chemical Co.
The Hommel, O., Co., Inc.

Sodium Silica Fluoride
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.

Sodium Uranate
Drakenfeld, B. F., & Co.
Harshaw Chemical Co.
The Hommel, O , Co., Inc.

Soot Blowers
Frazier-Simplex, Inc.

Special Machines
Frazier-Simplex, Inc.

Spar
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
Maxson, Elwyn L.
The Vitro Mfg. Co.

Spray Booths
The Hommel, O., Co., Inc.

Spraying Equipment
The Hommel, O., Co., Inc.

Spurs
Potters Supply Co.

Stacks
Lancaster Iron Works, Inc.

Steel Plate Construction
Lancaster Iron Works, Inc.

Stilts
The Hommel, O., Co., Inc.
Industrial Ceramic Products, Inc.
Potters Supply Co.

Sulfur
Stauffer Chemical Co.

Sulfuric Acid
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
Pennsylvania Salt Mfg. Co.
Stauffer Chemical Co.

Talc
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
Hammill & Gillespie, Inc.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
International Pulp Company

Tanks
Frazier-Simplex, Inc.

Tank Blocks
Corhart Refractories Co.

Tanks (Pickle)
The Hommel, O., Co., Inc.

Tanks for Raw Material Steel or Concrete
Lancaster Iron Works, Inc.

Tile (Floor)
Norton Co.

Tile (Muffle)
Carborundum Co.
Electro Refractories & Alloys Corp.
Norton Co.

Tile (Refractory)
Carborundum Co., (*Carbofrax*)
Electro Refractories & Alloys Corp.
Norton Co.

Tin Oxide
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
The Hommel, O., Co., Inc.
Metal & Thermit Corp.
The Vitro Mfg. Co.

Titanium
Drakenfeld, B. F. & Co.
Foote Mineral Co.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
Titanium Alloy & Mfg. Co.
The Vitro Mfg. Co.

Titanium Oxide
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
Foote Mineral Co.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
Metal & Thermit Corp.
Titanium Alloy Mfg. Co.
The Vitro Mfg. Co.

Trisodium Phosphate
Harshaw Chemical Co.

Trucks
Lancaster Iron Works, Inc.

Tubes (Insulating)
Carborundum Co.
McDanel Refractory Porcelain Co.
Norton Co.

Tubes (Pyrometer)
Carborundum Co.
Electro Refractories & Alloys Corp.
Leeds & Northrup Co.
McDanel Refractory Porcelain Co.
Montgomery Porcelain Products Co.
Norton Co.

Uranium Oxide
Drakenfeld, B. F., & Co.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.

Uranium Oxide (Yellow-Orange-Black)
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
The Hommel, O., Co., Inc.
The Vitro Mfg. Co.

Water Softening Plants
Frazier-Simplex, Inc.

Wet Enamel
The Hommel, O., Co., Inc.
Porcelain Enamel and Mfg. Co.
Titanium Alloy & Mfg. Co.
The Vitro Mfg. Co.

Whiting
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
Hammill & Gillespie, Inc.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
The Vitro Mfg. Co.

Winding Drums
Lancaster Iron Works, Inc.

Zinc Oxide
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
The Vitro Mfg. Co.

Zircon
Foote Mineral Co.
The Hommel, O., Co., Inc.

Zirconia
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
Foote Mineral Co.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
Metal & Thermit Corp.
Titanium Alloy & Mfg. Co.
The Vitro Mfg. Co.

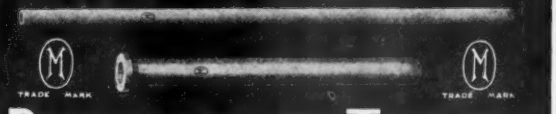
Zirconium Oxide
Foote Mineral Co.
The Hommel, O., Co., Inc.
Titanium Alloy Mfg. Co.

Zirkite (Natural ZrO_2)
Foote Mineral Co.

MONTGOMERY PORCELAIN PRODUCTS COMPANY

SPECIALIZING IN
Primary Protection Tubes for all makes of Pyrometers

MONTGOMERY



PYROMETER TUBES

★ MULLITE

★ REFRACTORY PORCELAIN

MONTGOMERY PORCELAIN PRODUCTS CO.
FRANKLIN OHIO

Fifty Years Experience Manufacturing Fans and Ventilating Machinery

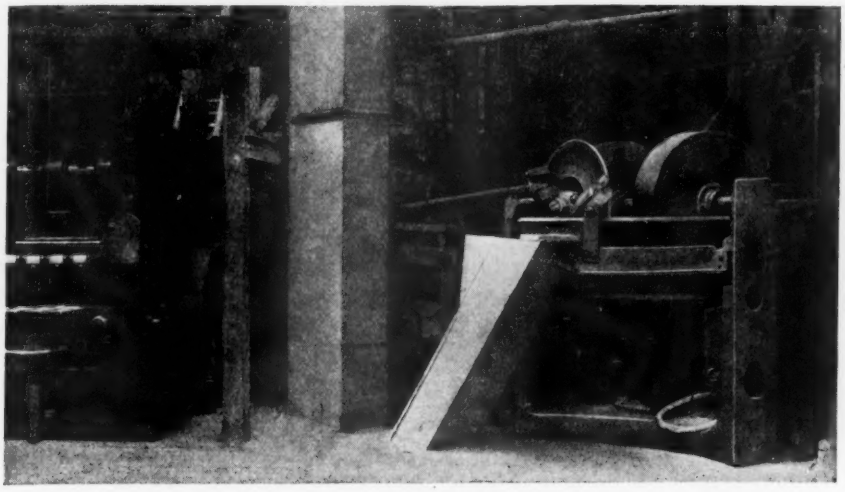
ROBINSON VENTILATING CO.

ZELIENOPLE, PA.

For fifty years we have been serving mining and industrial enterprises.

For fifty years we have continuously improved our products and services.

"STRENGTH and QUALITY"



Clearfield 610 Mixer preparing dry press refractories.

The CLEARFIELD (muller type) Mixer is the most efficient means of blending and tempering various raw materials used in the ceramic and allied industries.

We shall be glad to furnish information if advised of your requirements.

CLEARFIELD MACHINE COMPANY
Clearfield, Penna.

STARTING JANUARY 18TH

IT'S UP TO YOU!

STARTING January 18th, it's up to you to lead the men and women working in your plant to do themselves proud by helping to put over the 4th War Loan.

Your Government picks you for this job because you are better fitted than anyone else to know what your employees can and should do—and you're their natural leader. This time, your Government asks your plant to meet a definite quota—and to break it, *plenty!*

If your plant quota has not yet been set, get in touch now with your State Chairman of the War Finance Committee.

To meet your plant quota, will mean that you will have to hold your present Pay-Roll Deduction Plan payments at their peak figure—*and then get at least an average of one EXTRA $100 bond from every worker!*

That's where your leadership comes in—and the leadership of every one of your associates, from plant superintendent to foreman! It's your job to see that your fellow workers are sold the finest investment in the world. To see that they buy their share of tomorrow—of Victory!

That won't prove difficult, if you organize for it. Set up your own campaign right now—and don't aim for anything less than a 100% record in those *extra* $100 bonds!

And here's one last thought. Forget you ever heard of "10%" as a measure of a reasonable investment in War Bonds under the Pay-Roll Deduction Plan. Today, thousands of families that formerly depended upon a single wage earner now enjoy the earnings of several. In such cases, 10% or 15% represents but a paltry fraction of an investment which should reach 25%, 50%, or more!

Now then—Up and At Them!

Keep Backing the Attack!—WITH WAR BONDS

This space contributed to Victory by American Ceramic Society

This advertisement prepared under the auspices of the United States Treasury Department and the War Advertising Council

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We Sell—

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Fire Brick
Imported Paris White
Domestic Whiting
Georgia Kaolin
Modeling Clay

THE POTTERS SUPPLY COMPANY
EAST LIVERPOOL, OHIO

THE SEARCH THAT NEVER ENDS

IN THE industrial life of America, research has been of constantly increasing importance. And today it is a national resource, for the research of industrial and college laboratories is proving its value in War.

To the Bell System, research is an old idea, for the telephone itself was born in a laboratory. Behind its invention, sixty-nine years ago, were researches in electricity and acoustics and in speech and hearing.

And, ever since, there has been a laboratory where scientists have searched to know more about these subjects; and with their associated engineers have applied the new knowledge, fitting it with all the old, to make the telephone better and better.

Their fields of inquiry have broadened and deepened through these years; they inquire into all the sciences and engineering arts which have any promise of improving the telephone. Much has been learned but still more will be, because their search goes on. That is why the telephone laboratory grew to be Bell Telephone Laboratories, Incorporated, today the largest industrial laboratory in the world. And it exists to improve telephone service.

Improvements in industry can be left to chance in the hope that some one, sometime, will think of something useful; that some good invention will turn up.

The other way to make improvements is to organize so that new knowledge shall always be coming from researches in the fundamental sciences and engineering arts on which the business is based. From that steady stream will arise inventions and new methods, new materials and improved products.

This is the way of Bell Laboratories. Its search will never end. And as fast as it can the Laboratories will apply its new knowledge practically to the design of equipment and communication systems.

At present – and this started before Pearl Harbor – its trained scientists and engineers and all their skilled associates are concentrating on products of importance to our armed forces. But when this work is happily over they will be ready to continue their developments for the needs of peace.

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"Research is an effort of the mind to comprehend relationships no one has previously known; and it is practical as well as theoretical." . . . BELL TELEPHONE LABORATORIES

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AN M & T POSTWAR CERAMIC CHEMICAL

Here you see the picture of a postwar M & T ceramic chemical. It hasn't even been named yet, but as a development of wartime research at the M & T Ceramic Laboratory, it will contribute to better and more economically manufactured products when we are able to resume production of ceramic chemicals.

As usual the facilities of our laboratory will be available to customers in getting the most effective results from our products.

METAL & THERMIT CORPORATION
120 Broadway, New York 5, N. Y.

CERAMIC DIVISION